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EDITION OF
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THERAPEUSIS OF INTERNAL DISEASES

VOLUME VI

THE GEORGE BLUMER EDITION OF BILLINGS-FORCHHEIMER'S THERAPEUSIS OF INTERNAL DISEASES

CARE AND MANAGEMENT OF MALADIES AND AILMENTS OTHER THAN SURGICAL

VOLUME VI

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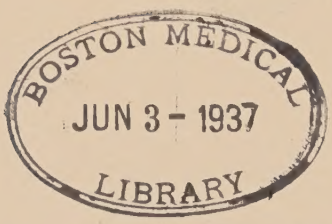

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DISEASES OF THE SEXUAL ORGANS

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CHAPTER I

GONORRHEA

Edward L. Keyes and Howard S. Jeck

The underlying principles for the treatment of acute urethral gonorrhea are quite different from those upon which the treatment of chronic urethral gonorrhea is based. And since our practice upon so rebellious a malady depends very largely upon the soundness of our principles it is essential at the outset that we define what is meant by acute and what by chronic urethritis.

Acute urethritis is an inflammation of the urethra of such severity as to cause pain, bleeding, or a profuse discharge of pus (exception made for the obviously chronic conditions about the posterior urethra, and its adnexa, that so commonly cause painful erections and painful urination, though manifestly not associated with any acute inflammation).

Chronic urethritis, on the other hand, is that inflammation of the urethra characterized by slight or intermittent discharge of pus, no pain (with the exception just referred to), and no spontaneous hemorrhage, unless this hemorrhage be due to stricture.

Acute gonorrheal urethritis usually lasts at least a month from the onset of the disease, for, although the acuteness of the inflammation may be controlled during this first month by the use of the so-called repressive treatment, the patient is, nevertheless, in a state of what might be called potentially acute gonorrhea, since, during this period, the gonococci reside in a mucous membrane not fortified by local immunity, and are, therefore, capable of exciting an acute inflammation if ever the repressive treatment fails, either through excessive zeal or through neglect.

Later in the disease, at any time while there are still gonococci in the urethra, an acute outbreak may occur, but this exacerbation differs from the original outbreak by its lesser severity, both in intensity and in duration. Moreover, subsequent attacks of gonorrhea are likely (doubtless because of local immunity) to be milder, briefer, and more readily controlled than the first outbreak. This is a fact always to be remembered in treatment.

Chronic urethral gonorrhea is divisible into three periods:

1. That of true chronic gonorrhea, during which the gonococci are still present.
2. That of postgonorrheal urethritis, during which a catarrh persists, although the original cause of that catarrh, that is, the gonococcus, has disappeared.
3. The period of postgonorrheal neuroses.

Needless to state, the duration of these conditions knows no precise limits. The postgonorrheal urethritis is usually brief; while the postgonorrheal neuroses differ in no respect from similar neuroses due to purely sexual causes.

TREATMENT OF ACUTE URETHRAL GONORRHEA

The treatment of acute urethral gonorrhea comprises five distinct topics:

The preventive treatment, the abortive treatment, the repressive treatment, the terminal or expectant treament, the treatment of complications.

Preventive Treatment

Gonorrhea in the male may be prevented by discouraging the male from visiting the foci of the disease, by disinfecting those foci, or by protecting the errant male by the use of a condom, or of preventive injections after exposure.

The prevention by social and moral means, by educating the young in a knowledge of their sexual instincts, and the dangers arising therefrom—this is at present receiving a world-wide trial. The elucidation of sexual matters in an intelligent and sympathetic way to adolescents can scarcely fail to prove a most efficient deterrent in many instances. And although generations will doubtless pass before the result of the crusade can be known this is surely the safest way of preventing gonorrhea.

Prevention of gonorrhea by disinfection of the foci of disease is practicable only in reference to the army and navy services, where the men, as well as the women, can be kept under observation. Reglementation in the world at large, where most women and all men are clandestine offenders, and, therefore, escape the law, has proved quite inefficient.

Personal prevention by the use of a condom is not as safe as it would appear to be, for we have known several men to become infected in spite

of an unbroken condom. Personal prevention by the use of antiseptic injection immediately after exposure is singularly efficacious.

Statistics of the army and navy show a reduction in venereal morbidity by the injection of 1 per cent protargol (or a similar antiseptic) applied within twelve hours of exposure and retained for three minutes.

Irrigation with 1 : 5,000 potassium permanganate is apparently equally efficient. The private citizen may protect himself by the injection with a minim dropper in the first inch or two of the urethra of a few drops of 5 per cent protargol in glycerin, by the instillation of a protargol bougie, or by the injection of a 1 per cent solution of the same. Of these methods the most efficient is probably the last, if the solution is freshly made from a powder (which can be conveniently carried about). Many other silver salts, if used in appropriate strength, are doubtless as efficient as protargol. The earlier the injection is made the more efficacious it is. The injection should never be repeated.

Theoretically acriflavine should make an excellent prophylactic. We have used it in a few instances as such, with apparently satisfactory results. The 1 : 5,000 solution is injected into the anterior urethra and retained for one to two minutes.

Abortive Treatment

The attempt to abort acute gonorrhea depends for its success upon the application to the urethra of a solution sufficiently strong to kill all gonococci in one, or, at most, in a few, applications. Although such methods may abort many cases, they are calculated to excite an acute urethritis, so that, if the last gonococci are not killed, their multiplication is encouraged, and failure implies a much more severe acute gonorrhea than if the patient had been treated from the outset by repressive measures.

In practice one aborts fully as many gonorrheas by repressive measures as by the abortive treatment, and one leaves those not aborted in a far better condition. For this reason we do not employ, and cannot advise, the use of abortive treatment. For those who wish to try it, however, the method described by Ballenger and Elder[1] is said to produce good results. They inject medication, preferably about 3 c.c. of a 5 per cent argyrol solution into the anterior urethra and immediately seal the meatus up with collodion. The solution is allowed to remain for from four to five hours. The procedure is repeated daily for four or five days and if by that time it shall have proved unsuccessful the abortive attempt is given up.

[1] The Technic for Sealing Medication in the Urethral Canal, by Edgar G. Ballenger and Omar F. Elder, Journal A. M. A., Mar. 23, 1918.

Repressive Treatment

The repressive treatment of acute urethral gonorrhea consists in the employment of all such measures as are calculated to destroy the gonococcus without irritating the urethra. The keynote to this form of treatment is the avoidance of all irritants. Repressive treatment is both general and local.

General Treatment

Cleanliness.—Inasmuch as any contact of the urethral pus with the patient's eyes is likely to excite virulent gonorrheal ophthalmia, he must be impressed with the necessity of cleansing his hands very carefully every time he touches the penis. For this cleansing no antiseptic is required; soap and water suffice. It is noteworthy that infants acquire gonorrheal ophthalmia with the greatest readiness; adults rarely do so. In almost fifteen years of office experience we cannot recall a single case of conjunctival infection among the patients who came to us with urethral gonorrhea.

The local cleanliness required applies chiefly to those patients whose discharge is free. If the foreskin is long, especial care must be taken in cleansing the preputial cavity, and hydrogen peroxid (diluted to one-third strength) may be required for this.

In order to keep the urethral discharge from reaching the clothes and irritating the foreskin, a protective dressing must be worn until the discharge has been reduced to a morning drop. The best dressing for a patient with a long foreskin is a strip of a 2-inch gauze bandage perforated to admit the glans penis. The gauze is slipped on back of the corona and then the foreskin is carefully pulled forward, holding the gauze in place. If the discharge is not profuse, a piece of cotton may be employed instead of this gauze. While, if the foreskin is short, the patient has to protect himself by wearing one of the so-called gonorrhea bags, or some home-made substitute for the same.

Rest.—Physical rest is one of the most important helps in the successful treatment of acute gonorrhea. It is impracticable to put the patient to bed. Indeed, it is questionable whether the mental disturbance excited by complete rest, with all the social and physical inconvenience this entails, would not do more harm than good. But, while the patient is permitted to be up and about, his business or pleasure should not include prolonged standing; any but the shortest walking; or riding in railroad trains or automobiles. All forms of exercise are prohibited.

The young man often finds this physical inactivity one of the most trying features of treatment, and it should be the physician's aspiration to relax his prohibitive rules as soon as this is possible.

A suspensory bandage, or jock strap, should be worn throughout the acute stage of gonorrhea, for the prevention of epididymitis.

Diet.—The rigorous diet usually prescribed excludes all alcohol, spices, condiments, rich and indigestible sauces and foods, fruit, coffee, tea, and sparkling water.

We have found it of no benefit to the patient's urethra to be so strict, and a great encouragement of his mind to permit a greater latitude. Alcohol, spices, and condiments must, of course, be prohibited, and it is well to specify ale, beer, cider, and ginger ale, besides insisting that any substance which burns the palate as it enters the body will burn the urethra as it issues forth (we speak, of course, of chemical, not of physical, heat). Indigestion, whether from overeating or from indiscreet eating, is harmful, and fruits, especially lemons and grape fruit, as well as asparagus, are apparently irritating, unless eaten in moderation. But there is no reason to prohibit these absolutely nor to prohibit tea or coffee at all.

Sexual Hygiene.—Absolute continence is essential, in thought as well as in act, throughout the acute stages of the disease.

Diluents.—Most patients should drink as much water as they can. But the exceptional man, whose capacity for water is unlimited, must be restricted to that amount which causes him to urinate every two hours; by exceeding this he would only irritate the urethra. If the patient can afford it, it is preferable that he drink an alkaline water, and, of these, Vichy Celestins is the best.

Internal Medication.—The drugs usually employed in the treatment of acute gonorrhea may be classified under four heads:

1. Urinary antiseptics.
2. Alkalis.
3. Demulcents.
4. Anodynes.

Urinary Antiseptics.—Urinary antiseptics, such as hexamethylenamin, methylene-blue, and the benzoates, have no beneficial effect upon acute urethral gonorrhea, and should not be used in this condition unless for the treatment of acute pyelonephritis complicating the gonorrhea. The use of salol (in the form of the compound salol capsule) is harmless, and may do good; but hexamethylenamin, though frequently employed, is certainly useless, and may be harmful to those whose urethræ are sensitive to this drug.

Alkalis.—Alkalis are employed in the treatment of acute urethral gonorrhea, on one of two theories: either that (1) the urine is overacid and irritating; or that (2) the gonococci thrive more upon an acid than an alkaline medium, and therefore the administration of alkalis directly attacks the gonococcus.

In times past we have inclined to the former theory, and have, therefore, administered alkalis only for the purpose of neutralizing an overacid urine. But further observation has convinced us that this is not enough; it is better that the urine should be alkaline rather than neutral; and therefore alkalis should be administered to all cases. In private practice the desired result may usually be obtained if, in connection with repressive local treatment, the patient drinks a quart or two of Vichy Celestins, or takes 15 or 20 gr. of sodium bicarbonate before each meal. But, in the clinic where a repressive treatment is relatively unsuccessful, or, in any case, if the local repressive treatment fails and the urethral inflammation continues intense, it is better to give one of the stronger alkalis.

The favorite urinary alkalizers are *potassium citrate, potassium acetate, liquor potassæ*. The dose of each is 5 to 15 gr. (0.3 to 1.0 gm.). They are usually given in combination with one of the prescriptions detailed below. The acetate is the most diuretic, but also the most difficult to digest. We therefore prefer the liquor potassæ or the citrate.

Demulcents and Balsamics.—The demulcents, such as buchu, pareira brava, uva ursi, etc., were much depended upon by the passing generation of physicians in the form of decoctions, the benefit derived being in proportion to the amount of water drunk with them; but they are no longer generally employed.

The balsamics, however, have a definite though limited value. Many patients do fully as well without balsamics as with them, but for others the effect of these drugs is manifest. They seem especially effective, however, in the treatment of non-gonorrheal urethritis, which is often promptly cured by balsamics without any other treatment. It is, therefore, probable that the chief effect of the balsamics is upon the mucous membrane rather than upon the gonococcus, and inasmuch as so many cases of gonorrhea do perfectly well without them it is obviously wiser not to administer them in doses large enough to upset the digestion or to cause any symptoms of poisoning. Since even small doses disagree with some stomachs, it seems preferable, if the patient cannot take with comfort a balsamic in the minimum dose here set down, that no effort should be made to administer it at all.

It seems unwise to attempt a discussion of the virtues of the many proprietary preparations of balsamics which are constantly appearing upon the market, supported by enthusiastic theorists and scientific claims. We have experimented with many of them, and have never found that they possessed any peculiar virtues. Therefore, while we may still hope for the appearance of a synthetic balsamic, singular both in its efficiency and digestibility, these need not delay us at present.

Among the older balsamics, four merit especial mention. These are sandalwood oil, copaiba, wintergreen oil, and cubeb.

1. Sandalwood Oil.—The oil of yellow sandalwood is probably the best of balsamics for most cases. It is administered in soft capsules, containing 5 or 10 minims (0.3 to 0.6 c.c.). The dose should be at least 5 minims (0.3 c.c.) three times a day. It is better to give 10 minims (0.6 c.c.), and few patients can take more than this with impunity. A favorite prescription combining alkalis and balsamics is the following:

℞ Potass. citrat. 8.00 to 25.00 gm. (℥ij to vj).
Ol. santal, 15.00 to 25.00 gm. (℥iv to vj).
Syr. acaciæ, 30.00 c.c. (℥j).
Aquæ menth. pip. q. s. ad 100.00 c.c. (℥iij).
M. Shake.
Sig. Teaspoonful in water two hours after eating.

2. Copaiba.—The balsam of copaiba is probably equal in efficiency to the oil of sandalwood, but it is much more difficult to digest. The dose is the same.

It is usually prescribed in capsules either alone or in combination with other balsamics, as in the so-called salol compound.

℞ Phenylis salicylatis, gr. iii (0.2 gm.).
Copaibæ, ♏x (0.6 gm.).
Cubebæ, ♏v (0.3 gm.).
Pepsinæ, gr. i (0.065 gm.).

Copaibal poisoning shows itself both by disturbance of the digestion (nausea, vomiting, etc.) and by toxic erythema, which usually consists in closely aggregated, slightly red blotches plentifully scattered over the trunk. The eruption itches and is readily cured by discontinuance of the drug and the administration of a laxative, and, if necessary, of warm baths containing 3 oz. (100.00 c.c.) of sodium bicarbonate to 10 gallons of water. This eruption, if severe, may be accompanied by fever and temporary subsidence of the urethral discharge.

3. Wintergreen Oil.—Wintergreen oil, whether natural or synthetic, is given in 10-minim (0.6 c.c.) capsules. It is not as efficient as either sandalwood or copaiba, but may be given in a dose of 10 minims (0.6 c.c.) three times a day to those patients with whom these balsamics disagree.

4. Cubeb.—This drug is also relatively inefficient, but may be given as a substitute for the stronger balsamics. It is rarely employed nowadays, except in the salol capsules already mentioned.

Anodynes.—For the *painful erections* and *chordee* of acute gonorrhea the best treatment is preventive. Erections may be minimized by sleeping with few covers and eating lightly at the evening meal. If they occur they may be relieved by urinating or by immersing the penis in cold water.

Drugs are singularly inefficient, although the following are recom-

mended to be taken on retiring: sodium bicarbonate, 15 gr. (1 gm.); lupulin, 30 gr. (2 gm.); codein, or the somnifacients, such as trional or veronal.

In *painful urination,* if the pain is due to injections, these must be discontinued; if to inflammation of the posterior urethra, the presence of prostatic abscess must be suspected.

The following anodyne mixture is often useful:

℞ Liquoris potassæ, c.c. 8.00-25.00 (℥ij-vj).
Tincturæ hyoscyami, c.c. 15.00-35.00 (℥ss-j).
Aquæ cinnamomi q. s. ad c.c. 100.00 (℥iij).
M.
Sig. Teaspoonful in water two hours after each meal.

An appropriate dose of codein phosphate or the bromids may be added to this prescription.

If the pain is terminal and due to spasm at the close of the act of urination, this may be minimized by instructing the patient not to empty his bladder completely, but let the last of the urine dribble away without the distressful piston stroke. The instruction is hard to follow but may afford great relief.

Hot water is valuable in various ways. The pain of urination may be modified by soaking the penis for a few moments in water as hot as can be borne and urinating into this.

Hot sitz baths are sometimes more efficacious, and, above all, hot rectal douches, as in the treatment of posterior urethritis.

The other measures mentioned under the head of local treatment of posterior urethritis are, of course, to be employed.

Instructions to Patients.—Of late years the commendable practice has arisen of distributing to dispensary patients suffering from venereal diseases a card indicating the chief dangers of the disease and the precautions they personally must take to encourage speedy cure and to protect their fellows. The following list for this purpose is copied, with but few minor changes, from that employed by Follen Cabot:

Instruction to Those Having Gonorrhea, or "Clap."—Gonorrhea, or "clap," is a contagious disease which requires treatment until the physician pronounces you cured.

To avoid infecting others, and to prevent complications, such as stricture, swollen testicles, etc., the following rules should be observed:

1. During the first few weeks walking should be limited. When the discharge is profuse you should keep off your feet as much as possible.

2. Do not use alcohol in any form, as it always prolongs the disease. Drink only milk, tea, coffee, and from six to eight glasses of water during the day.

3. Avoid all sexual relations until you have been pronounced cured by your physician, as the disease may be given to a woman even after the discharge has apparently ceased. When it is present you should avoid sexual excitement, as erections always aggravate the disease.

4. Always wash the hands after handling the parts. The discharge, if carried to the eyes, will cause blindness.

5. Sleep alone, and be sure that no one uses any of your toilet articles, particularly towels and wash cloths.

6. Never lend your syringe to any one, and as soon as you are well, destroy it.

7. Be sure that the bowels move every day. If they are inclined to be constipated, take a laxative.

8. Do not use mustard, pepper, horseradish, or stimulating sauces on your food. Do not drink ginger ale, beer, whisky, or alcohol in any form.

Local Treatment of Acute Gonorrhea

The preventive and abortive treatment for acute gonorrhea have already been mentioned. The repressive treatment consists in the employment of local treatment calculated to control the inflammation, but with the prime object of lessening the symptoms, the complications, and the probability of chronicity and of aborting the acute attack.

Repressive treatment, if properly conducted, aborts the disease quite as certainly as the so-called abortive treatments. But inasmuch as it is founded on the theory that the urethra should not be irritated in the effort to slay the gonococci, its results, when it fails to abort, are far more satisfactory than those of the violent so-called abortive measures.

Cases Suitable to Repressive Treatment.—The physician unfamiliar with the local treatment of urethral disease can expect but little success with the repressive treatment of gonorrhea. The expectant treatment will give him better results.

The physician moderately familiar with the subject should undertake this treatment with fear and trembling. He should apply it at first only to cases that he can absolutely control, who apply for treatment during the initial stage of the disease, before the meatus is much swollen, the discharge frankly purulent, the deeper portions of the urethra infected, or the pain on urination or erection at all marked. This admits most cases from one to three days old.

The expert will determine how far his personal success permits him to disregard the above rules.

In the clinic our control of patients is so poor that it is safer to employ repressive injections only upon patients who have had gonorrhea before and are peculiarly docile.

Acute gonorrhea in full blast, with marked swelling of the meatus, purulent discharge, and painful urination, is usually only made worse by local treatment. Exceptionally, however, and especially if the acute urethritis has persisted for a week or more, and a certain degree of local immunity has thus been acquired, very gentle injections, conducted exclusively by the physician himself, may control the acute inflammation.

Choice of Repressive Treatment.—There are at present two schools of urologists: the one depends upon injection of organic silver salts and acriflavine [2] for the repression of acute gonorrhea; the other upon irrigations with potassium permanganate. The success of the treatment with silver salts depends upon the painless and frequent injection of relatively strong antiseptic solutions in small [3] quantities. Acriflavine, too, should be injected only with the utmost gentleness. However, the solution employed should be relatively weak and the injections repeated much less frequently than in the case of the silver salts.

The success of the permanganate treatment depends upon the less frequent application of large quantities of a dilute solution. So that in the former methods of treatment we attempt to destroy bacteria; in the other we attempt to wash them out. We used the permanganate irrigation treatment for years, but have found that, although it promptly controls the discharge, it often leaves the patient with a chronic urethritis, extremely slow to get well. The silver salts, although they do not control the urethritis so quickly, cure it in our hands far more rapidly, while acriflavine both controls and cures the urethritis in a surprisingly large number of cases in a reasonably short time.

Technic of Injecting the Anterior Urethra.—The patient with a beginning urethritis is examined in the first place to determine the presence or absence of gonococci, and in the second place to determine whether the urethra is so inflamed as to prohibit repressive injection.

If injections are to be used the patient is placed upon the table, the

[2] Davis and Harrel first called attention to the treatment of gonorrheal urethritis by acriflavine in an article which appeared in the *Journal of Urology*, August, 1918. Acriflavine is an aniline dye and, according to their experiments, is an ideal drug for local use in gonorrhea because of its marked permeating and germicidal properties in dilutions weak enough to be relatively non-irritating. The advantage of acriflavine over the older preparations in the treatment of gonorrhea is still a mooted point among some urologists. To us, however, it has proved so satisfactory, especially in acute urethritis, that we use it almost to the exclusion of all other local medicaments.

[3] Laboratory reports showing the relative inefficiency of the organic silver salts as an antiseptic are frequently published, and although they show that a relatively slight bacterial action is exerted by these drugs, it is nevertheless the universal testimony of those who treat acute catarrhal inflammation in various parts of the body that these organic silver salts are undoubtedly efficacious in controlling acute inflammation of mucous membranes. Thus argyrol, confessedly the weakest of them, is successfully used in the treatment of urethritis, tonsillitis, rhinitis, and conjunctivitis.

end of the penis mopped clean, and the solution of choice gently injected from a blunt-nozzle glass syringe until back pressure or a leak between the syringe and meatus indicates that the urethra is full. The syringe is then removed and the injection retained by gentle lateral pressure upon the lips of the meatus. At the first injection the urethra will usually not hold more than 1 dram (4.0 c.c.); later it will hold 2 (8.0 c.c.). As soon as the syringe is removed the patient is asked whether the injection pains. If so, the injected fluid is permitted to escape as soon as this pain increases; if not, as soon as the burning begins. The patient usually complains of increasing pain within a minute or so at the first injection.

These instructions as to signs of irritation do not apply in the use of acriflavine. The latter should cause no pain or burning and should be permitted to escape at once if it does.

If protargol has been used the patient complains of much more pain for the first two or three minutes after the injection than while this is being given.

The patient is now instructed how to inject gently, holding the meatus open to receive the nozzle of the syringe, pressing lightly with thumb and forefinger on the lateral lips of the meatus. He is especially cautioned not to squeeze the meatus too tightly, but to retain the fluid by skill and not by force.

He is also instructed not to impede the inflow of the fluid by making pressure against the perineum, nor to encourage it by massage of the pendulous urethra, for massage of the acutely inflamed urethra is only calculated to do harm, while any effort to prevent the fluid from reaching the deeper portions of the urethra only keeps it out of the bulb, where it is most needed (after the first day or two). Indeed, the physician often finds it necessary to argue against the patient's fear of driving the gonococci into the deep urethra and bladder by injections. We well know that gonococci reach the deep urethra in at least 80 per cent of cases not treated by injections, and it is evident to any one using injections that they do not actually drive gonococci ahead of them, but only encourage the advance of the gonococci, if they are used in such strength or with such brutality as to congest the urethra. For this reason the patient is especially instructed to avoid pain in all his manipulations.

Inasmuch as pain is a relative term with a different meaning for each of us he is instructed to make all subsequent injections so brief and so gentle that the pain they excite shall be less than that excited by the first injection.

Organic Silver Salts.—Argyrol in 10 per cent to 20 per cent solution is probably the most popular injection. However, protargol in 0.5 per cent or 0.25 per cent is more efficient and infinitely cleaner. But, since protargol is more irritating than argyrol, it often cannot be used at the

outset. In such cases argyrol (or acriflavine[4]) may be employed until the irritation has subsided.

The patient reports to the physician for one of his daily injections until the latter is satisfied that the infection is fairly well controlled, as shown by the disappearance of the swelling at the meatus and the diminishing discharge. Afer this the patient may be permitted greater latitude, and may return for observation only every third or fourth day. He is instructed to repeat the injections from two to four times a day, retaining the fluid in the urethra from three to five minutes, unless he feels pain. But again and again it must be impressed upon him that, as soon as the injection begins to hurt, it is to be permitted to escape. In a promising case the discharge disappears completely in from two to four days, and the urine which the patient passes in two glasses at each visit shows only a slight haze in the first glass.

In the second week of the disease the discharge is likely to increase, and the problem now is whether this increase in discharge is due to the infection or to injection. In either case it is best to stop all injection for twenty-four hours, and meanwhile to examine the discharge carefully by smear for gonococci (there is no time for culture). Even if these are found it will usually be noticed that a twenty-four hours' remission of injection has resulted in lessening the discharge, and the injections are now resumed as before.

But, if no gonococci can be found in the discharge, the patient reports daily for examination, and, if necessary, he is given glass slides on which to smear his morning discharge. If three or four examinations fail to show gonococci, and the urine is becoming clearer all the time, the treatment is stopped, and the patient told to watch carefully for any sign of discharge, and if this appears he promptly reports for further examination. At the end of a week, without discharge or pus in the urine, he is probably cured. To verify this partially, a moderate-sized sound, 24 F. or 26 F. (or a Kollmann dilator) should be passed. Smears are then made of any discharge the patient may show the following two days on arising and before urinating. If these smears are gonococcus-free, even though they may show a little pus, additional evidence as to cure is sought by submitting the first urine passed, as well as the urine passed after massage of the prostate and vesicles, to culture. At the same time, it is well to take the patient's blood for the gonococcus complement-fixation test. If the latter prove to be positive in spite of other negative findings, a clean bill of health should be withheld until the case is investigated further. Conversely, however, a negative complement-fixation test, without the other tests, should not be regarded as sufficient proof to pronounce the patient cured.

[4] While not a silver preparation, acriflavine is mentioned here because of its applicability in the more irritable type of case.

Acriflavine.—The results of this relatively new preparation in the treatment of acute gonorrheal urethritis have been encouraging to say the least. We have used it for the past three and a half years and, taken all in all, it has proved more satisfactory as a repressive measure than any other urethral injection. But while seemingly a very innocuous preparation, acriflavine at times has a subtly irritating effect in the highest degree and must therefore be used with great caution.

The successful use of acriflavine implies four important factors:

1. The solution for injection should not be stronger than 1:5,000. One of the chief reasons for failure in the early use of acriflavine was the strength of the solution employed. Some urologists used it as strong as 1 per cent. While one injection of this solution would frequently clear up a copious discharge overnight, just as frequently the patient would return within the next twenty-four hours with the amount of his discharge doubled.

2. The injection should not be retained in the urethra for more than one minute.

3. The injection should be performed with the utmost gentleness.

4. At the very first sign of irritation, the injection should be discontinued.

The type of case most suitable for treatment with acriflavine is an acute urethritis in a patient who is able to make daily visits to the physician for at least five days. During this time he is given one injection daily by the physician and is warned on no account to take additional injections himself. The physician watches closely for signs of irritation and, if such appear, the injection is stopped at once. If, however, the case progresses satisfactorily, and if the patient be intelligent, he may be given a 1:5,000 solution of acriflavine with which to inject himself daily, returning to the physician at first every other day and later every three to five days.

The statements previously made regarding gentleness in the technic of injection should be especially emphasized in the use of acriflavine. The solution should be injected slowly and great care exercised to avoid distending the urethra. We employ either a bulb syringe for this purpose or one with a ground glass piston which works so smoothly that back pressure on the piston can be easily detected.

Should there be any question as to the patient's ability to properly inject himself, he should not be intrusted with acriflavine. He should continue to make daily visits to the physician until the acute condition has entirely subsided. But if circumstances will not permit of daily visits, then he may be given a fourth of 1 per cent solution of protargol or 10 per cent argyrol with which to inject himself two or three times a day as best he can.

We treat a number of patients by this combined acriflavine and organic silver salt method, and while it is not as satisfactory as acriflavine used alone, it, as a rule, gives better results than the silver salts alone. Likewise cases receiving daily acriflavine injections that show only slight signs of irritation may be treated to advantage by using acriflavine every other or every third day and one of the silver salts (preferably one-fourth of 1 per cent protargol twice a day) on the intervening days.

Treatment of Acute Posterior Urethritis.—Acute posterior urethritis, like anterior urethritis, is to be treated by injection from the onset, if it is seen early. But if the posterior urethritis is sufficiently severe to cause painful urination, all injection must be stopped and the disease treated by internal medication until this inflammation shall spontaneously subside.

For the local treatment of mild beginning posterior urethritis we employ preferably a 1: 5,000 solution of acriflavine. This may be given either as an irrigation by means of a catheter or by forced irrigation. The latter method is probably the one best suited to the majority of cases. For this we employ a blunt-pointed rubber bulb syringe. The solution is injected slowly and, when the resistance of the cut-off muscle is felt, gentle but steady pressure is made on the bulb until the muscle relaxes and the fluid is permitted to enter the posterior urethra. If this procedure causes a spasm of the posterior urethra, then the attempt should be discontinued at once. If, however, the patient takes kindly to it, the operation may be continued until from 2 to 6 ounces of solution have been injected. The patient is then instructed to empty his bladder.

The catheter method is usually employed in those cases that cannot relax the cut-off muscle during the forced injection or in those that do not respond to such treatment. In the first few injections by catheter, a woven instrument of small caliber should be used. The olive-tipped silk instillator of Guyon is an ideal instrument for this purpose. After the tip of the catheter has passed the cut-off muscle, about 4 to 6 ounces of solution is injected by means of any syringe which is satisfactory. The patient is then told, as in the case of the previous method, to empty his bladder, thereby flushing out the entire urethra from behind forwards. For the first few days of the posterior urethritis, the posterior urethra should be treated every other day and then once every third or fourth day. Throughout the course of treatment, frequent examination of the prostate should be made for fear of beginning prostatic abscess and, if the local treatment fails to control the local inflammation, it must be stopped and the treatment of severe posterior urethritis be instituted.

Instead of the acriflavine irrigations, protargol or silver nitrate may be used, the former preferably in 0.25 per cent solution as an instillation and the latter in strengths from 1: 5,000 to 1: 10,000, either as an instillation or irrigation.

Mercurochrome-220.[5]—This is the name given to another dye preparation, which is used in the treatment of gonorrheal urethritis. It is injected anteriorly and posteriorly in a 1 per cent solution, used for the most part as one would employ acriflavine. Rather much is heard of its fame but, in our hands, it has proved unsatisfactory.

Treatment of the Declining Stage—*Anterior Urethritis.*—In the declining stage of acute urethritis, both anterior and posterior, the course of the disease may be appreciably shortened in many instances by the judicious use of the bougie or sound, as employed by our associate Dr. Mohan.[6]

The type of anterior urethritis to which the method is applicable is one in which the very acute symptoms have subsided and where it is felt that the disease is held in check. There may still be present a discharge with or without gonococci. Such a stage may be reached within a few days or a few weeks from the onset of infection. In any event, the urethra is injected with a 1 : 5,000 solution of acriflavine immediately before the introduction of the instrument. A bougie or sound, 22 F. caliber or thereabouts, is very gently introduced into the urethra—only a few inches at the first introduction. The discharge, which will probably become more profuse on the following day, will, if all goes well, decrease to an amount by the fourth or fifth day which should be appreciably less than that at the beginning of the sound treatment. At this time the patient will probably be ready for another sound which may be introduced further into the urethra than the first one. The passing of sounds at proper intervals is continued until one may be introduced finally as far as, but not beyond, the cut-off muscle. In the interval between sounds the patient receives a daily injection or irrigation of 1 : 5,000 solution of acriflavine.

Of course, should there be an acute flare-up after any sound treatment, all local measures should be stopped at once and the patient put on expectant treatment until the acute condition shall have subsided. Finally, and in a relatively short time, a large sound or dilator may be introduced as one of the criteria of cure (see page 14).

Posterior Urethritis.—As in the case of anterior urethritis, only those acute posterior infections that are on the wane should be subjected to the early sound method. And yet it is not advisable to wait too long, because, to quote the author, "it appears to be valuable to interfere while the lesions are still fresh and tender and before they settle down into chronicity." Having passed the first sound or the second and third if necessary, only as far as the penoscrotal angle or bulb, the daily anterior injection is changed to a daily irrigation of the whole urethra for a day or two or

[5] Young, White and Swartz describe it as a preparation made by substituting one atom of mercury in the molecule of dibromfluorescin.

[6] Read before the section on Genito-Urinary Surgery of the New York Academy of Medicine.

more, when the first sound is passed all the way. The process may be repeated every five to seven days, irrigating the entire urethra daily with acriflavine in the interim.

Variation in the Treatment

No two cases can be treated precisely alike. The following chief variations in the treatment may be noted:

1. If the patient is first seen after his gonorrhea is well under way, but his physician still hopes to control it by repressive injections, he should use a mild solution 1:5,000 acriflavine (5 per cent argyrol, 0.25 per cent protargol) with the utmost gentleness and should closely supervise the progress of the case.

2. If pain supervene, either in the shape of increasing sensitiveness to injection, or pain on urination, or painful erections, the injection must be discontinued at least until these pains cease. If the pains do not cease upon the discontinuance of the injection, these may not be recommenced, but the patient must be treated expectantly.

3. If the discharge continues during the two weeks in some quantity, or if pus appears in the second glass, there is evidently posterior urethritis, and this must be attacked.

Permanganate Irrigation.—The permanganate irrigation treatment of acute gonorrhea we have found less efficacious than the methods just described. The method employed by Janet, who devised this system, is the following:

He irrigates the anterior urethra twice a day for three or four days, then increases the interval from twelve to eighteen hours. When the cloudiness of the first urine is almost gone he increases the interval to twenty-four hours. When the discharge is no longer purulent he makes it forty-eight hours.

When the second urine becomes cloudy he irrigates the posterior urethra according to the same method, twice a day at first, later every day, or every other day. For each irrigation of anterior or posterior urethra he employs 500 c.c. of fluid, at a temperature of 110° F.

If the case is seen before the appearance of marked inflammatory symptoms he employs a pint of 1:500 solution of permanganate, immediately followed by a like quantity of boric acid solution. If this does not prove too irritating he continues at this strength until the inflammation has subsided sufficiently to permit intervals of thirty-six to forty-eight hours, when he drops to 1:4,000 or 1:6,000 permanganate and omits the boric acid.

If the posterior urethra becomes inflamed he begins irrigating it with solutions of 1:4,000 down to 1:10,000. If these are well borne,

he increases the strength to 1:2,000 or 1:1,000, and follows it with a boric acid irrigation.

If the patient is first seen after the appearance of acute inflammatory symptoms the irrigation is begun at 1:10,000 to 1:4,000 strength, and only for the anterior, even if the posterior urethra is inflamed. He begins treatment of the posterior urethra only when the anterior inflammation is under control.

In the declining stage he gives a daily wash of 1:6,000 to 1:8,000.

Other Methods.—Valentine and the other followers of the Janet method in this country follow his method with certain variations. They usually employ much weaker solutions (1:4,000 to 1:20,000), and larger quantities (1,000 c.c. or more), and often irrigate the posterior urethra every day as a routine measure.

Expectant Treatment

The expectant treatment of acute gonorrhea consists in treating the disease solely by hygiene and internal medication, employing no local repressive measures, and beginning injections in the third or the fourth week, when the acute symptoms have begun to abate. Expectant treatment must be employed in all cases that are judged too severe when first seen for repressive measures, or prove rebellious to these. In some cases the treatment may be begun while discharge and pain are still quite severe, if one has waited in vain beyond the third week for any diminution of these. But as a rule it is safer not to inject until the local symptoms are decidedly diminishing.

Local Treatment of the Anterior Urethra.—If gonococci are still present in the discharge, the treatment is begun by anterior injection of acriflavine or protargol, as though the case were one of beginning gonorrhea. If this fails to do much good, after a few days permanganate irrigation is substituted: a pint of 1:6,000 permanganate solution, at a temperature of about 100° to 105° F. This solution is applied from the irrigator, the urethra being gently distended with the irrigator at a height of about two feet above the meatus. As soon as the anterior urethritis begins to improve, as shown by the lessening of the discharge, the posterior urethra requires treatment.

Local Treatment of the Posterior Urethra.—No treatment of the posterior urethra should be attempted until the inflamed anterior urethra is controlled. There is but one exception to this rule, mentioned elsewhere. The treatment of the posterior urethra is conducted by irrigation, as described under the treatment of chronic posterior urethritis.

Treatment of Complications

Abscess of the Urethral Glands.—Periurethral abscess at the frenum or in the pendulous portion of the urethra is no contra-indication to repres-

sive injections, if these are conducted gently. The best treatment of these conditions is to leave them undisturbed until the abscess points, when it may be permitted to break internally, or may be incised externally.

Periurethral Abscess.—Abscess in the glands of Cowper, or in the glands of the scrotal and perineal portions of the anterior urethra, usually spreads extensively beneath the skin before it suppurates frankly. It should therefore be incised as soon as a tendency to spreading is manifest. Meanwhile the repressive injections may be continued, unless the urethritis contra-indicates.

Balanoposthitis.—Gonorrheal balanoposthitis can usually be prevented by cleanliness, and, if it occurs, is usually controlled by application of any non-irritating disinfectant powder. If the balanoposthitis is severe, the best wash is hydrogen peroxid, diluted to one-quarter strength with warm water. This should be applied twice a day, and the surfaces kept separated by a perforated piece of gauze.

Lymphangitis and Adenitis.—If the lymphatics of the dorsum of the penis become inflamed during a gonorrhea this is due to infection in the periurethral tissues or within the preputial cavity. When these are controlled the lymphatic inflammation subsides. The complication is rarely of any importance, for it is most unusual that it should go on to suppuration, requiring incision.

Gonorrheal inguinal adenitis is due to the same causes and rarely suppurates.

Acute Posterior Urethritis.—It is necessary to distinguish precisely those cases in which there is probably acute prostatitis from those in which there is none. If the prostate is not inflamed, symptoms of acute posterior urethritis call for cessation of all local treatment. The patient should not exercise at all, and it is preferable that he stay in bed, if that is possible, while vigorous treatment is conducted with alkalis and sedatives, and hot rectal douches. If after a few days the symptoms continue very intense, in spite of this treatment, relief may perhaps be afforded by instillation into the posterior urethra of 2 or 3 drops of 2 per cent silver nitrate solution. If pain persists in spite of instillation, the case is to be treated as one of acute prostatitis.

Acute Prostatitis and Prostatic Abscesses.—The best treatment of prostatic abscess is its prevention by the exercise of the hygienic precaution and the gentleness in local treatment already insisted upon. If abscess should occur the treatment consists in:

1. Stopping all urethral treatment.
2. The administration by mouth of some soothing urinary antiseptic, with whatever sedative and laxative may be necessary.
3. Insistence upon the general rules of antigonorrheic treatment, especially as to physical rest (rest in bed, if there is fever).

4. Hot sitz baths or hot rectal douches, with the hot-water bag as a local sedative.
5. Catheterism and bladder wash if there is complete retention.
6. Very gentle massage.

As a result of this treatment we look for prompt relief of two symptoms, namely, fever and retention.

If the patient's temperature does not, within a few days, fall to and remain below 100° F., and if acute complete retention is not almost immediately relieved, the abscess should be promptly operated upon.

Seminal Vesiculitis.—Inflammation of the seminal vesicles, during an acute gonorrhea, is overshadowed by the concomitant prostatic inflammation. Abscesses of the vesicle requiring incision are extremely rare.

Cystitis.—The treatment of gonorrheal cystitis is that of posterior urethritis as described above.

Pyelonephritis.—Pyelonephritis resulting from gonorrheal infection requires the same treatment as does that lesion when caused by other bacteria.

TREATMENT OF GONORRHEAL EPIDIDYMITIS

Prophylaxis.—Gentleness and discretion in the treatment of acute gonorrhea are requisite for the prevention of epididymitis, yet one may expect to see a small percentage of cases complicated by inflammation of the epididymis in spite of every care.

The wearing of a suspensory bandage minimizes the danger of epididymitis, yet in many secondary gonorrheas one may dispense with this precaution. But during the first gonorrhea, and during the acute stages of posterior urethral infection, the suspensory should always be worn.

Posture.—By far the most important elements in the successful treatment of acute gonorrheal epididymitis are elevation and immobilization of the testicles. If the attack is a mild one it may sometimes be aborted by proper support without putting the patient to bed or without applying any other treatment, yet such cases are very prone to relapse. When the inflammation is at all severe the pain is so intense that the patient practically has to remain in bed whether he wishes to or not.

While in bed the testicles should both be elevated as high as possible and immobilized. To achieve this end, no bandage sold in the shops is as efficient as one constructed from adhesive plaster as follows:

The bandage consists of the following parts: (1) A strip of adhesive plaster about 20 inches long and 4½ inches wide. (2) Midway of its long diameter and adjacent to one edge on its sticky side is placed a small roll

of gauze about 2 inches long and one-half inch in diameter. The latter is securely fastened by means of a narrow strip or two of adhesive folded over it and stuck transversely across the long strip. (3) Two tail pieces of adhesive about 1 inch wide and 24 inches long.

To apply the bandage, the middle portion of Part No. 1, sticky side up, is placed underneath the scrotum in such a manner that the small roll of gauze rests against the perineum with the scrotum and contents in front of the roll. (It is advisable to interpose a double thickness of

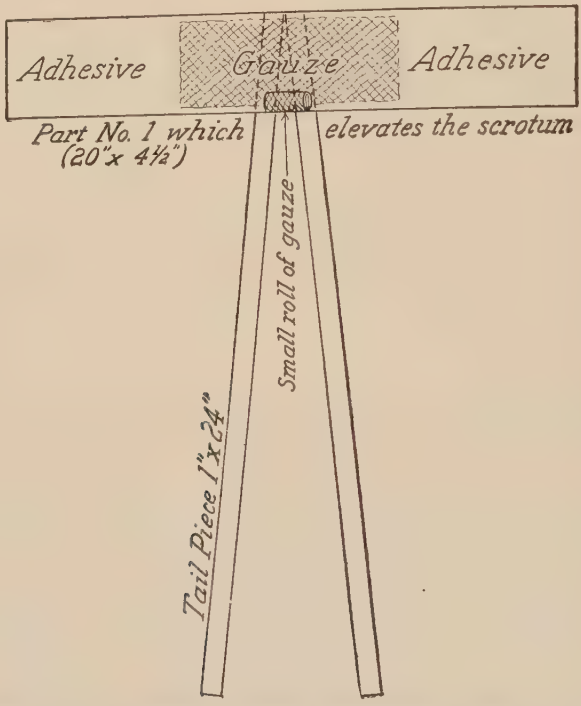

FIG. 1.—DIAGRAM OF THE ADHESIVE PLASTER SUSPENSORY BANDAGE FOR EPIDIDYMITIS. This shows the bandage made up for hospital use.

gauze about 4 by 8 inches between the adhesive and the skin to prevent the latter's sticking to the scrotum.) Taking an end of the strip in either hand, the scrotum is gently lifted up until the testicles are in front of the pubes. The free end is then plastered down on either side in such a way that it is bisected lengthwise by a line drawn from the pubic spine to the anterior superior iliac spine. The end of each tail piece (Part No. 3) is now stuck to the back of Part No. 1 underneath the scrotum and is then carried backwards, over the gluteal fold, and its other end anchored on the front of the abdomen in the neighborhood of the anterior superior iliac spine.

To prevent the abdominal parts of the bandage from becoming loose, one or two strips of adhesive should be placed transversely across the lower part of the abdomen, crossing both ends of Parts Nos. 1 and 2. These strips also help to tighten up Part No. 1, making the entire bandage fit more snugly.

If there is a tendency for the scrotum to slip forward, a narrow strip or two of adhesive plaster may be placed across the front of the scrotum and anchored to the sides of Part No. 1, virtually making a suspensory bag for the scrotum.

In hospital practice, where help is comparatively abundant, the bandage is usually made up in numbers as a single dressing (see Fig. 1). In private practice, however, the construction of the bandage as it is being applied is more practical since it is obviously easier to handle a single strip of adhesive plaster single-handed than several strips pasted together.

While shaving the patient permits of a more perfect application of the dressing, it is not absolutely necessary since gauze may be interposed between all the hairy parts and the sticky side of the adhesive plaster.

FIG. 2.—BANDAGE FOR EPIDIDYMITIS. Showing the position of Part No. I and the two tail pieces.

If the bandage has been properly applied, its lower surface stands at right angles with the long axis of the patient's body, and when so applied this bandage is calculated in almost all cases to dissipate the pain and fever within forty-eight hours. The average length of time he remains in bed with this dressing is from three to five days. After this, if he has no pain and his temperature has been normal for twenty-four hours, he may be allowed gradually to resume his daily routine while still wearing the bandage. About a week later, if the patient is still free from pain, he may, for the sake of convenience, substitute an ordinary suspensory bag for the adhesive dressing. The former can be made much more effective by the following scheme: Pin the center of a 4-inch muslin bandage about 6 feet long to the under surface of the suspensory. Holding the bandage with both hands placed one on either side of the scrotum, the

hands are raised directly upward until the scrotum is lifted as high as comfort will permit. The two ends of the bandage are then carried behind the patient's back, crossed at the lumbar region, and then brought forward around his waist to the front where they are tied.

Fig. 3.—Bandage for Epididymitis Completed. Note the re-inforcing transverse abdominal adhesive strips.

This dressing has the advantage of allowing the patient to change it himself. However, it should not be used as a substitute for the adhesive plaster dressing in the beginning of acute epididymitis.

General Treatment

The bowels are likely to be constipated, and this must be attended to. The patient is kept upon a fluid diet as long as the temperature is above 100° F. Sometimes the administration of 1 or 2 minims of tincture of aconite every two hours is efficacious in relieving pain, by dilating the blood-vessels. The other remedies employed, such as gelsemium and veratrum viride, are doubtless no more efficacious.

Vaccine Treatment.—After some years of experimentation we are still in doubt as to the value of vaccines. In private practice, where the patients are not fully under control and the treatment by rest and suspension, therefore, not so efficacious, 50,000,000 gonococci may be administered every two days for three or four doses. In hospital practice, however, the patients are so promptly relieved by elevation of the testicle that there seems to be no advantage in the use of vaccines.

Local Application.—A great number of local applications have been employed at various times in the treatment of this inflammation. One's preference is largely a matter of fashion. Thus the tobacco poultice once universally used is now scarcely mentioned. Its virtues consisted in its heat, and one obtains this as well with the more familiar flaxseed poultice, somewhat less well with a hot-water bag. Strong theoretical objections have been urged against the use of cold, yet many patients obtain much more relief from the application of ice-bags than from poultices, and we

usually apply an ice-bag over the bandage while the patient is in bed, unless the pain is promptly relieved by the bandage alone. Applications of pure guaiacol or equal parts of guaiacol and glycerin are painful, but sometimes appear to help on the first day of the disease. We used to employ them constantly but have given them up of late years. The saturated solution of Epsom salts we have not found efficacious.

FIG. 4.—BANDAGE FOR EPIDIDYMITIS COMPLETED. Lateral view.

Treatment of the Declining Stages. — Most cases require nothing more than good suspension after they have left bed, but if the edema is slow to disappear resolution may be hastened by strapping.

First tie a soft cotton string tightly around the scrotum above the inflamed testicle so that this cannot slip upward. Then take a piece of thin rubber bandage some 2 inches wide and long enough to surround the swollen gland; apply to the end of this a short narrow strip of adhesive plaster, and strap the rubber bandage as tightly around the testicle as the patient can bear it, fastening it in place with the adhesive plaster so that it shall not slip off. The advantage of this form of strapping is that it does not adhere inconveniently to the skin and may be reapplied as tightly as the patient can stand it every day, or every other day, as the swelling recedes.

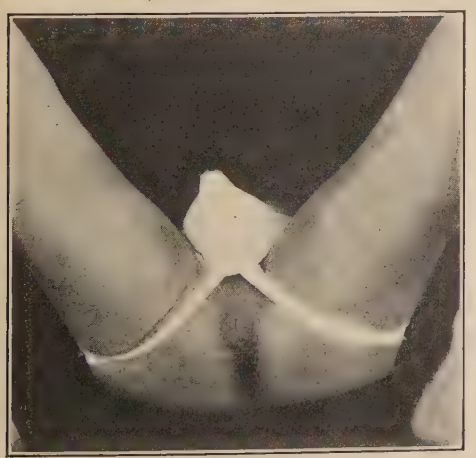

FIG. 5.—BANDAGE FOR EPIDIDYMITIS COMPLETED. *Perineal view.*

Treatment of the Urethra.— No local treatment of the urethra is permissible during the attack of epididymitis, nor for a week, or even more, thereafter, lest irritation of the urethra should excite relapse.

Operative Treatment.—The observations of Hagner have stimulated interest in the operative treatment of epididymitis. Although we have operated upon a number of cases, we do not feel that the knife should be employed excepting in those rare instances when proper support and the application of cold or heat (whichever is more grateful) fail to relieve pain. Moreover, operation can only be undertaken with the knowledge that the five days required for the healing of the wound, under the best of circumstances, may keep the patient rather longer in bed than if he had not been operated upon.

Treatment of Recurrent Epididymitis.—Immediate recurrence is usually prevented by abstention from local treatment of the urethra. On the other hand, a tendency to relapsing epididymitis may often be controlled by prostatic massage, while in certain cases relapse appears to depend upon a small smoldering focus of suppuration in the epididymis. This may be attacked either by vasotomy or by incising the little mass in the epididymis.

CHRONIC GONORRHEAL URETHRITIS

General Treatment

It is difficult to define precisely what should be the general treatment of chronic gonorrheal urethritis, for this treatment, beginning at the termination of the acute stage, takes up the patient at a time when exercise and alcohol are absolutely prohibited with the object of carrying him from that condition into one of free exercise and sometimes of free alcohol, neither putting him back by rashness nor delaying him by overcaution. It is not sufficiently recognized by most medical men that there comes a time when a patient with gonorrhea, who has been prohibited from exercise for a number of weeks, goes "stale," as the athletes say, and the young man thus deprived of his accustomed exercise becomes morbidly depressed, so that he can scarcely be expected to throw off his infection. Under these circumstances, even though gonococci persist in the urethral discharge, a patient must be advised to begin exercise, at first very gently.

The best beginning is made with dumb-bells or some similar form of exercise that puts most of the strain upon the arms. Vigorous leg work, such as tennis and swimming, should not be attempted until the patient has had at least a week or two of preliminary experiment of a milder sort.

Thus feeling his way, the physician attempts not only to get his patient back to a normal manner of living, but even to make him exercise rather more than is his custom. The mental and physical stimulation of this often goes far to cure an intractable chronic case. On the other hand, the possibility of setting up acute infection in the urethra, the prostate,

or the epididymis, by intemperate exercise or straining, is never to be forgotten. This danger sometimes persists even after gonococci have disappeared.

A similar difficulty exists in the regulation of alcohol. Alcohol makes the urine irritating to the urethra, and such irritation is inevitably bad for acute urethritis. But after the gonococci have disappeared (and sometimes even before this) the irritation of alcohol may (exceptionally) be beneficial rather than harmful, for it is to be remembered that some of the drugs that we apply in the local treatment of chronic urethritis act chiefly as counterirritants. Thus the alcoholic, who boasts that, after months of chronic gonorrhea, he has thrown physics to the dogs and gone on a wild debauch, which has cured him, often speaks the truth. Happily, however, the physician need not employ such intensive treatment. One or two drinks of beer a day will do as much good (and far less harm) as many times that number. One must remember, however, that alcohol is, in the majority of cases, and unto the bitter end, much more harmful than beneficial.

Medication.—The various alkalis and balsamics, which are so useful in acute urethritis, are usually of no benefit in chronic cases, except during acute relapses. If the urine is so acid as to be constantly full of irritating crystals, this tendency must be corrected. On the other hand, some benefit may occasionally be derived from free water drinking, and it is not to be forgotten that some cases of chronic gonorrhea depend for their continuance upon some other lesion not connected with this malady, such as tuberculosis, nephritis, or diabetes.

Change of Surroundings.—When exercise and hygiene and medication all fail to bring a patient mentally and physically up to par, and he continues to drag on weary months of chronic urethral catarrh in spite of intelligent local treatment, he may sometimes be cured by going away for a vacation. It matters not where he be sent if only the locality be healthy, his occupation and method of living be radically changed, and his tastes be consulted. One has recourse to this method of treatment rarely, yet I have seen it followed by the best of results, the patient getting well either during his trip or immediately upon his return.

Sexual Hygiene.—While gonococci persist, sexual intercourse is as likely to reinfect the gonorrheic as it is to infect his partner. But, after their disappearance, it is likely to do good by relieving the sexual congestion of one who is (presumably) accustomed to frequent sexual intercourse. The irritation of ungratified sexual desire, the effort to check the sexual habit, is to many gonorrheics the most distressing feature of the disease.

Local Treatment

No absolute rules for the local treatment of chronic urethritis can be made to apply to all cases, for the condition consists of a chronic catarrh,

which, while it chiefly attacks the prostate, the seminal vesicles, and the surface of the posterior urethra, also involves the anterior urethra, or may be confined in the latter portion of the canal, and which may or may not be complicated by stricture.

A precise diagnosis of the site, character, and obstinacy of the lesions, as well as the presence or absence of gonococci, is an essential preliminary to intelligent local treatment.

Thus we have cases that will get well rapidly if let alone, others that will never be cured unless they are treated locally, others again peculiarly susceptible to certain forms of treatment and made worse instead of better by measures that one would suppose, a priori, calculated to do good. Nor are we speaking of exceptional cases, unless indeed we might say that every case of chronic urethral gonorrhea is an exceptional case. To the beginner this is so, no matter what rules he may follow. He cannot be too careful in applying them, and must attack each urethra for the first time, whether by injections, irrigations, sounds, or urethroscope, with a great fear in his heart. The expert knows no rules, and is a misleading guide, because he inevitably presupposes in the beginner some of the discretion and dexterity which he has unconsciously attained through years of experience and practice.

Hence, whatever may be hereinafter set down must be accepted with reserve, and applied in a purely experimental way, for each practitioner must learn through his own experience to what degree all rules are applicable to him, and in what measure his hand and mind may employ them to his patients' advantage.

Injections.—The first local treatment to be employed upon a patient with chronic urethritis is injection into the anterior urethra. This injection is made by means of a 2-dram (8.00-c.c.) blunt-nozzle piston or bulb syringe. Of the piston syringes in use, those with ground glass plungers are the best.

A great variety of solutions are employed, but here, as in the acute variety, acriflavine is usually the most efficient remedy when the discharge is profuse and creamy and full of gonococci. The organic silver solutions, of which protargol in 0.25 to 0.50 per cent solution is the type, are likewise good. Yet even in these cases both acriflavine and the organic silver solutions are sometimes useless and the so-called astringents are preferable. In all milder cases, if there is a discharge through the day, astringents are likely to help control this. The most favored injections have as a foundation some of the forms of zinc.

Zinc sulphate, in 0.2 per cent to 1 per cent solutions, is frequently used.

Potassium permanganate, in 1:3,000 to 1:5,000 strength, is probably of little value as a rule.

Zinc permanganate (1:2,000) we think well of.

Perhaps the best injection is:

℞ Zinci sulphatis 0.25 gm. (gr. iv).
Lig. plumbi subacetatis diluti, 100.00 c.c. (℥iii).
M.
Sig. Shake. Inject morning and night.

The astringents favored by other authors are:

℞ Hydrargyri chloridi corrosivi 0.03 gm. (gr. ss).
Acidi carbolici 0.8 c.c. (♏xii).
Zinci sulphocarbolatis 0.8 to 4.0 gm. (gr. xii to ʒj).
Boroglycerini (25 per cent) 60.0 c.c. (℥ij).
Aquæ, q. s. ad 200 c.c. (℥vj).
(White and Martin).

℞ Zinci acetatis,
Acidi Tannici, āā 1.3 gm. (gr. xx).
Aquæ rosæ 125.0 c.c. (℥iv).
(White and Martin).

℞ Zinci sulphatis 1.0 gm. (gr. xv).
Plumbi acetatis 1.3 gm. (gr. xx).
Tincturæ opii; Tincturæ catechu, āā 65.0 c.c. (ʒij).
Aquæ ad. 200.0 c.c. (℥vj).
(Brou).

℞ Zinci sulphatis; Aluminis, āā 0.3 to 0.6 gm. (gr. jv. to gr. xij).
Acidi carbolici 0.3 c.c. (♏jv).
Aquæ 125.0 c.c. (℥jv).
(Ultzmann).

℞ Zinci sulphatis 0.7 gm. (gr. xij).
Resorcin 1.5 (gr. xxjv).
Aquæ 125.0 c.c. (ʒjv).
(Morton).

℞ Acidi nitrici 0.18 to 1.0 c.c. (♏ iij to xv).
Aquæ 250.00 c.c. (℥viij).
(Baumann).

℞ Cupri sulphatis 0.2 gm. (gr. iij).
Aluminis crudi 1.0 gm. (gr. xv).
Aquæ 250.00 c.c. (℥viij).
(Kreissl).

℞ Extracti hydrast. fl.; Bismuthi subcarbonatis; Boroglycerini (25 per cent), āā 25.00 c.c. (ʒvj).
Aquæ distillatæ, ad 200.00 c.c. (℥vj).
(White and Martin).

℞ Ichthyol 1.3 to 6.0 gm. (gr. xx to ʒjss).
Aquæ, q. s. ad 125.00 c.c. (ℨjv).
(Baumann).

℞ Berberine hydrochlorat. 0.3 gm. (gr. v).
Aquæ 250.00 c.c. (ℨviij).
(Belfield).

It were vain to try this formidable array of drugs upon any one patient. If one or two of them fail, the rest are likely to, for the failure is more often due to the inaptitude of the method of treatment than to inappropriateness of a given drug.

Excepting acriflavine and the organic silver salts, none of these injections should be retained more than long enough to distend the canal. It is unwise to employ them oftener than twice a day, or less often than once a day.

Irrigations.—The therapeutic effect of injections into the anterior urethra is obviously restricted to that part of the canal, though gonorrheal inflammation almost inevitably extends to the posterior urethra. Hence, injections are useful in bringing the anterior urethra to a condition to permit the passage of instruments and fluids necessary for the treatment of posterior urethritis, and also for the purpose of calming the patient's apprehension by making him feel that he is doing something for his discharge; but the real work must usually be done with irrigations or instillations to reach the posterior urethra.

Choice of Method of Irrigation.—The urethra may be irrigated with or without a catheter. Irrigation without a catheter is preferred in many clinics, because it is more readily performed and is adapted to most cases.

But, though there is doubtless no material difference in the therapeutic value of one or the other method, if properly employed, the routine employment of irrigation without a catheter permits the physician to overlook many lesions, such as stricture, retention of urine, etc., which would be called to his attention if he followed the other method. We therefore much prefer, and employ, the catheter.

Technic of Irrigation without a Catheter.—The instruments required are a glass nozzle to fit the meatus and an irrigator hung upon the wall in such a way that it may be elevated or depressed at will. The patient first urinates, then stands over a sink (though the first injection under these circumstances may result in his fainting, and it is, therefore, preferable that the patient lie down until he becomes accustomed to the treatment). The irrigator is filled with the solution to be injected, elevated 3 to 4 feet above the urethra, and the fluid then permitted to enter the urethra gradually. As the patient feels pressure upon the wall of the canal he is instructed to relax his muscles by going through the motion of urinating without endeavoring forcibly to expel the urine. Other patients

manage better if simply told to relax their muscles, while others again do better if told to breathe in and out rapidly, imitating the panting of a dog. Some patients readily learn the trick, others defy all efforts to train them. One obtains better results with some by employing a fairly large bulb or piston syringe, with a rubber nozzle coupled to it; with this the pressure can be varied in proportion to the resistance of the urethra.

Technic of Irrigation with Catheter.—The entrance of instruments into the urethra should always be cleanly and gentle.

Asepsis.—The asepsis of catheterism implies three requisites:

1. Asepsis of the physician's hands.
2. Antisepsis of the patient's urethra.
3. Asepsis of the instrument introduced.

The best rule of cleanliness for the physician's hands is that, having washed his hands, he should act as if they were still dirty. The last 3 inches of the instrument should not be touched by anything except sterilized lubricant from the time it is sterilized until it enters the urethra.

Asepsis of the patient's urethra is, under the present circumstances, amply cared for by the antiseptic of the solution, which is to be introduced through the catheter, and which will wash the urethra clean upon its emission.

Asepsis of the Instrument.—This implies three conditions:

Aseptic lubrication.
Cleanliness and sterilization after use.
Aseptic preservation.

1. Lubrication.—Oily lubricants, such as vaselin or olive oil, though they themselves may be sterilized by boiling, prevent proper sterilization of the instrument to which they are applied by coating it with an imperceptible oily film very difficult to remove. Thus Albarran found that, while an unoiled catheter may be cleansed by boiling for ten minutes, an oily catheter required thirty minutes' boiling to clean it. Moreover an oily lubricant cannot be employed for cystoscopes. Glycerin and boroglycerid are frequently employed. Of the commercial products, K. Y. is one of the best lubricants. We find it highly satisfactory.

2. Instrument Sterilization.—All urethral instruments should be sterilized immediately after use. Sounds and rubber catheters may be readily sterilized by boiling. Woven instruments of the best French makes may also be boiled, if the following rules are observed:

The boiler must be long enough to contain the instrument without bending it, and without touching it at either extremity. The instrument must be completely immersed in the water. The instrument must not be bent in the least degree before it has cooled. Therefore it is best to boil it in a receptacle with a tray upon which the instruments are lifted out and

cooled somewhat before they are used. Finally the instrument should not be boiled for more than fifteen minutes at a time.

Cystoscopes cannot be boiled. They must be sterilized in formalin vapor. No peculiar apparatus is required for this. The instrument must simply be kept in an air-tight instrument case, in which a formalin lamp is lighted, for at least an hour. It has become our custom of late simply to keep a small dish of formalin solution (containing formaldehyd 38 per cent) in the instrument case, changing the solution every few days or often enough to maintain a strong odor of formaldehyd.

Needless to state, all instruments should be mechanically cleansed with soap and water and dried before they are sterilized.

3. Aseptic Preservation of Instruments.—The instrument case to contain catheters, sounds, etc., may be sterilized with the formalin lamp or solution, and it is convenient to have the sterilized instruments thus preserved in a sterile case. Yet one must observe the precaution of dipping them in sterile water or saturated boric acid solution before using them lest the deposit of formalin upon them irritate the urethra.

Asepsis of Tanks, Syringes, etc.—It is our custom to keep all small syringes, mixing rods, and instillators in a 20 per cent formalin solution, supersaturated with borax. Hypodermic needles are better kept in ethyl alcohol as they rust less readily in it than in formalin.

Large syringes may be sterilized with formalin in the instrument case.

Wall tanks, graduates, etc., may be kept sterile by using them only for antiseptic solutions. It should be the urologist's practice to have a special type of glass for urinary specimens, in order that these may not by any chance defile his solution containers.

Asepsis of Solutions.—All solutions should be made up fresh, warm, and aseptic, a supply of hot, sterile water being at hand. The chemicals to be kept in stock for solution are shown in the table on page 33, which also indicates the strength in which they are commonly used.

Instillations.—The term instillation is applied to the treatment of urethritis by the application to the urethra of a few drops of concentrated solution, while irrigations consist in the application of a large amount of relatively dilute solution. Instillations are usually applied only in the posterior urethra; application of strong solution to the anterior urethra being preferably made through the urethroscope.

Instruments Employed.—Although an instillation may be made with a soft-rubber catheter and a piston syringe, it is so difficult to gage the precise amount injected that it is preferable to use special instruments. Of the two instruments employed for this purpose, that of Guyon consists of a silk-woven capillary tube with a bulbous extremity, in which are one or more orifices and a funnel end for the adaptation to it of the nozzle of a syringe. The Keyes instillator consists of a small blunt metal catheter, with a capillary lumen, and the orifice at the tip, while the outer end

Chemicals for Solutions

Name	Form	Injection	Irrigation	Instillation
Argyrol	Crystals	5 to 20% †	3 to 10%	10 to 50%
Protargol	0.5 gm. powders...	0.25 to 1% †	0.1 to 0.5 %	1 to 5%
Acriflavine* ...	Powder or tablets.	1:5,000	1:5,000	1:2,000
Potass. permang.	1 gr. tablets.....	.....	0.01 to 0.03%	.....
Silver nitrate...	10 per cent sol....	.....	0.01 to 0.02%	0.2 to 10%
Hg. oxycyanid..	0.25 gm. powders..	.....	0.03 to 0.2 %	.....
Zinc sulphate...	1 per cent sol.....	0.5 to 4%	0.1 to 0.5 %	.....
Zinc permang...	1 per cent sol.....	0.2 to 0%	0.05 to 0.2 %	.....
Copper sulphate.	10 per cent sol....	.....	0.02 to 1 %	0.5 to 5%

* We find a 10 per cent solution of acriflavine to be very convenient for use. One minim of this solution to an ounce of water gives approximately a 1:5,000 dilution. Neutral acriflavine, one of the newer preparations, is put on the market in convenient sized tablets. Acriflavine powder is best dissolved by sprinkling it on top of distilled water in a graduate of fairly large diameter and allowing it to stand for from six to eight hours.

† Must be retained three to ten minutes in the urethra.

is fitted with a screw to adapt it to a hypodermic syringe. Syringe and catheter are also made in one piece, but such an instrument is not convenient. The Guyon instrument has the advantage of passing more painlessly into the urethra, but it is not always possible to insert it into the posterior urethra, and the instrument is not durable.

The Keyes instrument is more difficult to pass painlessly, but it can always be inserted into the posterior urethra, and is much more durable.

Technic of Instillation.—The instillator is filled with the solution to be employed, and gently introduced into the urethra until its tip is in the membranous urethra. The contents of the syringe are then ejected into the membranous and prostatic portions of the canal. One can usually tell when the instrument has entered the membranous urethra by feeling its tip ride over the bulbomembranous junction.

If the Keyes instillator is being used any doubt as to the position of its tip may be settled by noticing the position of the shaft of the instrument. So long as the point has not entered the deep urethra the shaft will tend to incline at an angle upward toward the patient's body. As the point engages, the shaft naturally falls downward toward the patient's feet. After withdrawing the instrument, if the fluid has been injected into the posterior urethra, none of it flows from the meatus.

Solutions Employed.—Silver nitrate, in strength of from 0.2 to 10 per cent, is the favorite solution for instillation. Copper sulphate is also employed in the same strength. Our preference is 0.5 per cent to 5 per cent carbolic acid. Acriflavine, 1 : 2,000, works well in some instances. Sublimate, 1:20,000 up to 1:2,000, is instilled in the treatment of tuberculosis, and thallin sulphate is employed for cases that are too sensitive for silver nitrate.

Instillations have an unmerited bad name among the laity, because it is so easy to instill into the posterior urethra an unduly strong solution of

carbolic acid or silver nitrate which will cause acute suffering for many hours. This is quite unnecessary, but can be avoided only by the exercise of the greatest conservativeness in making the first injection. The sensitiveness of the posterior urethra varies to a remarkable degree. Some patients are tortured beyond endurance by the instillation of 0.5 per cent solution of silver nitrate, while others bear with composure an instillation of 10 per cent. The majority of patients seem to be less sensitive to carbolic acid and usually experience nothing more than a temporary discomfort from even the first instillation of a solution as strong as 1 per cent. But it is wiser to test the sensitiveness of the posterior urethra by the passage of instruments and the use of irrigations before attempting instillation, and always to begin with a solution no stronger than 0.2 per cent. Moreover, inasmuch as the pain excited by instillation varies up to a certain point in proportion to the amount of fluid injected, it is better, at least in the beginning, to instill not more than 2 drops of the solution, and, inasmuch as it is often the object of this treatment to apply the strongest solution that the patient can bear, it is often better to instill only this minute dose in order that the strength may be more rapidly increased.

Uses of Instillations.—Instillations are employed under three circumstances:

When the patient suffers from acute posterior urethritis, unaccompanied by a palpable change in the prostate and vesicles, but associated with persistent and intensely painful and frequent urination, the instillation of a few drops of 1 per cent carbolic acid or silver nitrate into the posterior urethra, though it may be extremely painful, is sometimes followed by the most remarkable relief of symptoms. If the first instillation does not help it should not be repeated.

When the posterior urethra has recently become inflamed and no instruments have previously been employed, less trauma is inflicted upon this portion of the canal by treating it with instillations than by any other form of treatment, provided the instrument is skillfully introduced. Under such circumstances one desires to apply rather large quantities of relatively dilute solutions, such as 10 c.c. of 0.1 per cent silver nitrate, or 0.5 per cent protargol, or 10 per cent argyrol.

The routine employment of instillations, however, finds its place in the treatment of mild chronic posterior urethritis.

Here the dose is a few drops, the favorite remedy carbolic acid, beginning at 0.5 per cent and increasing at intervals of twice a week. A similar technic is employed for instillation after the passage of sounds.

Dilatation and Massage.—Many chronic gonorrheas recover with no local treatment whatever, or under treatment of injection and irrigations. But, if there is urethral stricture or chronic prostatitis and vesiculitis, these lesions, though they sometimes cease to give symptoms under such

treatment, often do not yield to it, and even when they do are likely to cause a relapse of symptoms after a shorter or longer interval.

The treatment of stricture is such a special subject that we must deal with this apart.

The treatment calculated to cure chronic anterior urethritis, prostatitis, and seminal vesiculitis is dilatation and massage.

The action of urethral dilatation and massage of the prostate and vesicles upon chronic intractable catarrh of these organs is twofold. In the first place the treatment actually expresses from the tissues the pus and bacteria within the urethral and prostatic glands. In the second place it softens inflammatory exudates and encourages a more firm and normal contraction of the urethral and prostatic muscles about the inflamed glands, at the same time producing hyperemia, which encourages the resorption of inflammatory tissue and the cure of glandular catarrh.

One might suppose, therefore, that every intractable urethritis required dilatation, but this is far from being the case. In certain patients the symptoms are only aggravated by these mechanical treatments, and, though temporary aggravation is not always a bad sign, yet if repeated gentle treatments continue to provoke an increase of symptoms, the mechanical violence is evidently doing more harm than good, and the patient is better without them. Hence, it is well to reserve massage, and even more carefully to reserve dilatation, for those cases that are incurable without it. One can scarcely be too enthusiastic about the advantage of these methods of treatment if one constantly bears in mind the possibility that they may do harm.

Technic of Dilatation.—As a general rule, if examination with the bulbous bougie or the urethroscope reveals an induration in the anterior urethra, which is not promptly ameliorated or cured by irrigations, it should be dilated. Dilatation should be begun with sounds, and these should be carried to the limit of the meatus; progress being made slowly, not more than two or three numbers at a given occasion. The passage of the sound should be preceded by the administration of hexamethylenamin, 7½ gr. (0.5 gm.), t. i. d., for forty-eight hours, and followed by an instillation along the whole urethra of a few minims of 0.2 to 0.5 per cent silver nitrate or by an irrigation with 1 : 5,000 acriflavine, 1 : 5,000 potassium permanganate or 1 : 10,000 silver nitrate.

With the sound in the urethra this canal should be carefully palpated for infiltrations or glandular indurations, and these should be gently massaged upon the sound every time it is introduced until they disappear, or until it becomes evident that they are permanent scars.

The passage of the sound may be repeated as often as twice a week if it excites no increase in discharge. But, if the sound irritates, it should not be reinserted until this irritation has subsided, and, in such cases, it

is preferable not to repeat the sounding oftener than once in five or seven days.

When the limit of the meatus has been reached, dilatation should proceed by means of the Kollman dilator. Never having employed the irrigating dilator we cannot discuss its advantages. We have at times employed the various dilators that are adapted to distend only certain portions of the canal, selecting the instrument in accordance with the urinary and urethroscopic findings. But the precise accuracy of these means of diagnosis is to be gravely mistrusted, and, since the inflamed portion of the canal is always narrowed, we have come to believe that dilatation of uninflamed regions is not so likely to do harm as is the possible oversight due to dilating only one portion of the canal when actually the whole canal requires treatment. Therefore we now employ almost exclusively the Kollman dilator that stretches the whole canal.

Much more experience is required in employing the dilator than the sound, for, in introducing the sound, the resistance of the indurated portion of the canal or the bleeding which follows its removal are indices to guide the gentleness of the manipulator.

But, in using the dilator, the physician is working, not only against the resistance of the walls of the canal, but also against the resistance of the mechanism of the instrument itself, and therefore the amount of force justifiable in the use of one dilator is no guide to that justifiable with another. As a general rule, the dilator should be used so gently as to excite no bleeding and no inflammatory reaction for longer than twenty-four hours. The force required for this is different for each instrument and for each case. The increase in size with each instrumentation should be as in the use of the sound; not more than two or three numbers of the French Charrière scale.

There appears to be no advantage in leaving sounds or dilators in the urethra for more than a few moments after the desired dilatation has been achieved.

If the introduction of any metal instrument causes bleeding, small instruments (20 to 25 F.) should be repeatedly introduced until this tendency to bleeding has been overcome.

Contra-indications to Dilatation.—Dilatation is always to be done with great caution while gonococci still persist in the urethra, and, under these circumstances, the dilator is more dangerous than the sound. The same rule holds true so long as the urine contains free pus, even though no gonococci can be found. Yet sometimes gonococci and free pus cannot be gotten rid of excepting by dilatation.

On the other hand, when the urine contains only shreds, dilatation is more likely to do good, less likely to do harm.

Exceptionally, dilatation does harm when carried to the posterior urethra, though it is required in the anterior urethra.

The harm done by dilatation consists in exciting pain or an increase in the flow of pus from the urethra or in causing epididymitis.

Limits of Dilatation.—The natural limit to dilatation is the cure of the patient's symptoms, but certain restrictions may be put even upon this. When dilatation does good it should be carried to at least 28 or 30 F.,[7] and it is wise to see the patient a year later to be sure that no relapse of urethritis or contraction of a beginning stricture has taken place.

Some cases, on the other hand, are benefited by dilatation up to 35, 40, and 45 F. But many urethras resent being stretched to such dimensions, and dilatation should always be desisted from when it appears to do harm rather than good.

Massage—*Technic.*—Massage of the prostate and vesicles should be practiced with two principles in mind. In the first place, the whole of these organs should be massaged, even when the greater part of them may appear normal. In the second place, more attention should be paid to those regions that are palpably diseased.[8]

The question whether it is better to massage prostate and vesicles gently or harshly is one that cannot be categorically answered. The more recent or the more acute the inflammation of the parts the milder should be the massage; and, in our belief, even old chronic cases do better under prolonged gentle massage than under more vigorous handling. But no one can tell how hard any other man massages. Indeed, it is probable that no one employs precisely the same amount of force in two successive treatments. Therefore this question must be left to the discretion of each individual, with the warning that severe massage is more likely to excite inflammatory reaction, although it is required in some intractable cases.

One cannot perform satisfactory massage with instruments. The sense of touch is necessary for delicate and accurate manipulation.

A simple method is to begin upon one vesicle, and, reaching up as far toward the fundus as possible, to press upon it, and then withdraw the finger in a zigzag way until one reaches the prostate. This maneuver is repeated half a dozen times, and then the same treatment given to the opposite vesicle. If the vesicles are impalpable, this is enough. If distended or indurated, the maneuver should be repeated often enough to make a distinct reduction in their size, if the patient can bear so much manipulation.

The finger is then brought down to the prostate. Hard, angular indurations in and about this organ had best be avoided, and pressure made

[7] This does not apply to the treatment by sound of the declining stage of acute posterior urethritis with which one might confuse chronic posterior urethritis.

[8] Diagnosis of inflammation of the prostate and seminal vesicles depends upon the discovery, by means of the microscope, of pus in the secretion expressed from these organs. Hence in many cases we massage organs that are not palpably diseased.

chiefly upon the more yielding portions of the gland. Beginning with one lobe, pressure is made upon it either with a to-and-fro lateral sweep of the finger or with a circular motion. This manipulation, if gentle, may be continued for one minute; if severe, half a dozen strokes may suffice. The same treatment is given the opposite lobe of the gland, and the manipulation concluded by a half dozen strokes over the prostatic sinus for the purpose of emptying the main ducts into the urethra.

The progress of the cure is gauged by the amount of pus (as seen under the microscope) expressed from the meatus or passed in the urine after massage.

Irrigations are employed in connection with massage in order to wash away the pus extruded into the urethra and also to heal its superficial lesions. While gonococci are present, it is usually wiser to irrigate, but, after these have disappeared, one sometimes does better by omitting all intra-urethral treatment.

Mild massage may be repeated twice, or, exceptionally, three times a week; severe massage not oftener than once a week. Massage every day almost invariably makes the patient worse.

Massage should be continued until the subjective symptoms are relieved, and the return shows no more than a few leukocytes to each microscopical field. When this point has been reached, it is well to discontinue massage for a month or more, when the patient returns for another treatment. If he is doing well the pus is usually found to have decreased. If pus has reaccumulated, a few rubs usually bring it down again, and the patient should be continued under treatment in courses of from four to six rubs and with intervals of from two to four weeks until the reaccumulation of pus ceases.

Contra-indications to Massage.—Massage is dangerous only in the presence of acute inflammation of the urethra, the prostate, the vesicle, or the epididymis; but massage is harmful in case it increases the patient's subjective symptoms instead of relieving them. It is also harmful in case it so hypnotizes the patient that he thinks he must come for the rest of his natural days to be rubbed for the relief of imaginary discomforts. Such patients should be discouraged from massage by all possible means. Their proper cure is sexual relief by matrimony.

The Rectal Douche.—The rectal douche is an accessory or substitute to massage of the prostate and vesicles. The usual case, that can perfectly well submit to massage, need not bother with douches. But if the patient cannot reach his physician often enough for massage, if the inflammation is too acute for massage, or if massage proves irritating or in any way harmful, the rectal douche should be employed. The object of the rectal douche is to apply heat or cold to the prostate or vesicles. For this purpose the closed tube, or psychrophore, may be employed, but the open double-current tube is better.

If no double-current tube is to be had, Tuttle's apparatus may be employed. It consists of two large soft-rubber catheters, bound or sewed together, side by side. The water flows in through one, out through the other. When the outlet is plugged with feces the current is reversed. Of the special tubes, we find Chetwood's model more convenient than those of Kemp or Tuttle.

The patient fills a 2-quart douche bag with saline solution at 125° F., attaches it to the tube, hangs the bag so that its elevation above the outflow shall be about 2 feet, and greases the tube with vaselin.

He then seats himself toward the back of a privy seat, leans back against the wall, grasps the tube with his thumb at about its middle, opens the cut-off of the douche bag until the water flows warm through the tube, and then inserts the tube into the rectum for about half its length. He then turns the water on, and it flows into the rectum. If it does not return through the outflow he stops the inflow as soon as the rectum feels full, pokes about with the tube until a gush of water announces that it is in the right position, then turns the water on again. It takes from four to eight attempts before the patient learns to do the trick neatly.

The injection should be repeated every day, with an interval of a few days, every two or three weeks, to make sure that the bowel is not being irritated. Some patients note an immediate sense of relief from the use of this rectal douche, but the majority do not, and it is often difficult to persuade a patient to go on, week after week, using a treatment which is a great nuisance and which does not appear to him beneficial. Yet the rectal douche is one of the few forms of treatment that we consider it wise to continue for months at a time, with only such intervals as are necessary to insure the safety of the bowel.

Operative Treatment

Although Young and Alexander have counseled prostatectomy for the treatment of chronic prostatitis, an operation is likely to do more harm than good unless there is acute abscess, chronic obstruction in the form of urethral stricture, or bar or stricture at the neck of the bladder giving symptoms similar to those of prostatic hypertrophy.

Ligation of the vas deferens sometimes exercises a markedly beneficial effect upon intractable prostatitis and vesiculitis, but, since this operation makes the patient sterile, it is permissible only upon old men and upon such young men as suffer from relapsing epididymitis, incurable by any other means.

Urethroscopic Treatment

The urethroscope is more generally applicable to the diagnosis than to the treatment of urethritis. Intractable cases of urethritis may, how-

ever, be due to persistent suppuration in one or more single follicles or glands in the anterior urethra, or to suppuration in a para-urethral duct. In either case, direct treatment through the urethroscope is indicated. Injections of a drop of 20 per cent silver nitrate solution may be made once or twice a week, or, if the canal is long, it may be slit up into the lumen of the urethra, whereupon it will promptly heal.

Such conditions are rare, however. As a rule, chronic urethritis is a diffuse process, although certain spots in the mucosa show more evidence of inflammation than others, and treatment of these spots by application to them of silver nitrate solution, introduced on a swab through the urethroscope is not so likely to effect a cure as is the treatment of the sclerosis by dilatation.

Granulations in the posterior urethra constitute the commonest pathological condition, which can be diagnosed by the urethroscope as a cause of intractable urethritis. They may be long and fingerlike or stubby, but in either case are readily destroyed by the high frequency current or topical applications of acid nitrate of mercury.[9] We prefer the latter as it is simpler and not so painful.

Urethral polyps or papillomata may be conveniently burned off through the urethroscope by means of the high-frequency current, the galvanocautery, or by repeated application of 20 per cent silver nitrate solution or acid nitrate of mercury, full strength.

If there are numerous urethral warts, it is convenient to destroy these in part by catching them between the edge of the urethroscopic tube and a large cotton swab, which is pushed beyond the warts and then withdrawn so as to amputate them against the edge of the tube. After the irritation from this procedure has subsided, the base is burned off.

The modern direct vision urethroscope of Geiringer, Goldschmidt and Buerger is the instrument of choice in the diagnosis and treatment of pathological conditions in the posterior urethra. The indirect vision instrument of McCarthy is especially serviceable for fulguration.

Treatment of Postgonorrheal Urethritis

After gonococci have disappeared from the urethral and prostatic discharges, the sclerosis and glandular catarrh may persist for an indefinite time in the urethra or in the prostate or seminal vesicles. Under such conditions the treatment is much the same as that for chronic gonorrheal urethritis, with the exception that dilatation may be employed with more impunity and safely carried to a greater degree than when gonococci are still present.

One important thing to realize in these cases, however, is the neces-

[9] Liquor hydrargyri nitratis—a liquid containing in solution about 60 per cent mercuric nitrate.

sity of stopping local treatment at a certain point. This point is usually reached when the secretion expressed from the prostate contains only a few leukocytes; when there is no longer any free pus in the urine; when urinary shreds have become relatively small and contain very few pus cells; when the urethral discharge has become mucoid and sticky in character, and contains only a few pus cells. When these conditions are reached, the patient is likely to do better under general and sexual hygiene than under any local treatment. Indeed, one often sees such cases, in whom constant local treatment only aggravates symptoms, which would subside if left to themselves.

Vaccine Treatment.—Until the principles of vaccine therapy and the efficiency of the various bacterins and sera are more clearly understood, it seems quite hopeless to endeavor to bring order out of the chaos of conflicting competent observations concerning the use and value of this form of treatment.

We have employed vaccines, both stock and autogenous, but have failed to derive any great benefit from them, excepting in the treatment of incipient epididymitis and gonorrheal rheumatism.

Inasmuch as the method of manufacture and strength of these preparations are never twice the same, it is impossible to give formulæ which can be generally applied. Each preparation should be employed according to the rules laid down by the laboratory from which it comes.

Treatment of Relapsing Prostatitis.—Certain patients who have suffered from severe prostatitis in the course of gonorrhea (and some whose original prostatitis was not due to the gonococcus) suffer from time to time from relapses which may be characterized chiefly by urethral discharge, or by outbreaks of chills, fever, and pyuria. Such attacks are usually brief and may be separated by months or even years. They are curable by prostatic massage, which should be given in courses of a month or two, with increasing intervals, until the patient has been watched and found free from tendency to relapses for at least a year.

Spermatorrhea.—This is the title given to two distinct conditions: On the one hand, the patient's urine, when voided and examined under the microscope, may prove to contain spermatozoa. It is most unwise to call the patient's attention to this condition, as it is quite harmless, although the knowledge may fill him with strange fears.

On the other hand, the patient may extrude from his prostate and seminal vesicles a drop or more of semen when he has a movement of the bowels. Constipation, of course, increases the amount of discharge, which may be the source of considerable alarm, and which sometimes occurs under other conditions; thus it may follow the act of urination or any muscular strain. This condition is entirely harmless, as such. If the seminal fluid extruded is not mixed with pus it simply means that the

muscles of the internal genitals are somewhat relaxed, and, while the amount of discharge may be materially diminished by regulating the patient's sexual affairs and constipation, and by occasionally massaging the prostate, it is unwise to depend upon physical measures for a cure, since, in spite of them, a slight discharge is likely to persist. This is harmless, and the patient must be instructed to disregard it.

Treatment of Retention Due to Chronic Prostatitis.—Exceptionally the result of chronic posterior urethral and prostatic catarrh is sclerosis either of the whole posterior urethra or of the neck of the bladder, which results in partial retention of urine by the same mechanism as that of prostatic hypertrophy. Such cases can only be cured by division of the neck of the bladder, which is preferably done by means of the Young punch, the Geraghty punch, or a similar instrument by Caulk, which burns instead of cuts its way through the obstruction. In either instance a cylindrical segment of the obstructing tissue is removed.

URETHRAL STRICTURE

Prophylaxis.—To prevent traumatic stricture, perineal section should be done at the time of injury. To prevent gonorrheal stricture, every effort should be made to minimize the intensity of the inflammation, for, although stricture may result from chronic mild catarrh of the urethra, such stricture is usually readily dilated, while dense and unmanageable strictures are the result of intense urethritis or periurethritis.

Curative Treatment.—To cure a urethral stricture is not always possible. Stricture of the urethra anterior to the penoscrotal angle may be cured by dilatation to 32 or 34 F., or by cutting to this size. But the more common and more troublesome strictures of the deeper portions of the anterior urethra, notably those in the region of the bulb, while they may be controlled by dilatation, are often incurable, and will relapse after an interval of months or years in spite of any treatment.

Resection of the urethra (Cabot's operation) may achieve a permanent cure. It certainly changes intractable, resilient strictures into manageable ones. But many years must elapse before we can be sure that complete cure can be obtained even by this operation.

With this possible exception, stricture should always be treated by dilatation rather than by incision, and operation should be looked upon only as the means of opening a stricture which cannot be dilated or of curing some of the complications of stricture. After operation the sound is required as much as before.

The treatment of stricture may be considered under the following captions:

1. Stricture of large caliber.
2. Stricture of small caliber.
3. Stricture admitting only a filiform.
4. Stricture complicated by retention.
5. Impassable stricture.
6. Traumatic and resilient stricture.
7. Inodular or indurated stricture.
8. Stricture complicated by prostatitis (irritable stricture).
9. Stricture complicated by false passage.
10. Stricture complicated by periurethritis or prostatic abscess.
11. Stricture complicated by acute pyelonephritis.
12. Stricture complicated by fistula.

Treatment of Stricture of Large Caliber.—A stricture of large caliber is one which will admit a 20 F. sound. Such strictures, if not complicated, are to be treated by dilatation with steel sounds or dilators. If the stricture does not dilate it is to be treated as a resilient stricture (see below). If the passage of instruments excites inflammation or chill, the treatment is that of irritable stricture.

The passage of sounds into the urethra should always be followed by antiseptic washing with acriflavine (1 : 5,000), silver nitrate (1 : 10,000), potassium permanganate (1 : 5,000), or by instillation of silver nitrate (0.2 to 0.5 per cent) into the posterior urethra. We employ the latter treatment, as it seems not only antiseptic, but also helps to close up any minute abrasions that may be made in the urethra by its mild cauterizing effect. Furthermore, unless in an emergency, it is wiser to precede the passage of the sound by the administration of hexamethylenamin (gr. x, t. i. d.) for two days, until the temper of the urethra is known, after which the antiseptic may be dispensed with.

Finally, and above all, the sound must be passed gently.

The first operation upon a stricture should consist in the passage of a moderate-sized sound (20 F.). If this passes, it is wiser not to pass another instrument until the effect of this first instrumentation can be judged. If the sound does not pass, the stricture may be classed as one of small caliber. The patient is told to return in from three to five days, and then a sound is passed, either of the same size or one size less than that passed on the previous occasion. If this passes readily, an instrument two sizes larger may be introduced, and, if this also passes without much force or bleeding, an instrument one or two sizes larger is introduced, and the operation closes with an instillation of silver nitrate. Thus the dilatation proceeds with intervals of at least three, and preferably five or six, days between each passage of sound. Thus, with very gentle dilatation, we hope to gain from one to three numbers of the French (Charrière) scale on each occasion.

If the stricture responds kindly to dilatation, the first check is the size of the meatus. A meatus so small that there is a distinct pocket behind it, as indicated by a probe inserted into this, should be cut. But a normal meatus (which varies in size from 27 to 32 F.) is usually the standard for the limit of dilatation. When the stricture has been dilated to this size, the intervals are increased to two, four, six, eight weeks, and, if still there is no tendency to recontract, to three months, six months, and a year.

A stricture anterior to the penoscrotal angle that does not recontract after an interval of a year may be regarded as cured.

But deeper strictures require the passage of a sound once a year for the remainder of the patient's life, to insure against relapse.

This sounding can, of course, be performed more skillfully by the physician than by the patient, but, inasmuch as no patient was ever known to return year after year for the passage of a sound, it is only fair to recognize this human weakness and to instruct the patient how to pass a full-size sound upon himself. After having boiled it, and thoroughly washed his hands and penis, he celebrates with this instrument the advent of each Fourth of July or New Year's Day.

If, on any of these happy anniversaries, he is not able to introduce his instrument, he should apply at once to a physician for relief.

In some instances, however, the size of the meatus is not an adequate gauge of dilatation. In such cases the stricture relapses within the year and dilatation must be carried to a higher point with a Kollman dilator, the limit in these cases being that size at which the stricture does not relapse after an interval of a year.

Treatment of Stricture of Small Caliber.—A stricture of small caliber is one that will admit a 10 F. instrument, but will not admit a 20 F. Such strictures are to be dilated with woven bougies according to the rules laid down above until these have reached the size of 20 F., when steel sounds continue and complete the cure.

Treatment of Stricture Admitting Only a Filiform.—Strictures that will not admit a 10 F. bougie may be classed under this heading. Such strictures are very frequently impassable, irritable, or resilient, and must be treated accordingly. But the proper employment of filiform instruments reduces the number of impassable strictures to a very small one.

The choice of instruments to dilate a filiform stricture is one of the most delicate tests of the experience of the urologist. All filiforms should be of the smallest possible caliber. A truly threadlike instrument often passes where another with a bulb the size of the head of a pin will not pass. Whalebone filiform bougies, such as are commonly employed in this country, should be selected with reference to their fineness and smoothness. The tips of these may be bent at an angle by immersing them in collodion and then bending the tip to the desired angle, and hold-

ing it in this position until the collodion dries. The outfit should include at least one-half dozen instruments.

As followers to the filiform, one should have two tunneled silver catheters, and at least two tunneled sounds, sizes 10 to 14 F. The eyes of such instruments should be large enough to slip readily over the filiforms.[10] The Banks bougie, with its filiform tip enlarging to a thick shaft, makes a convenient substitute for the filiform and guided sound, since it can be introduced with much less danger of tearing the urethra.

Woven filiforms to screw on to a following catheter or bougie are made by various French firms; their disadvantage of being less stiff and less durable than the whalebone instruments is counterbalanced by the advantage of their fineness and smoothness. These instruments are also made with a copper wire core, which adds to their rigidity and gives the additional advantage that they can be bent at the tip to any desired angle.

Introduction of Filiforms.—Filiforms are apt to catch in the urethral folds and crypts, both in front of and behind the stricture. The following maneuvers are employed to overcome this difficulty:

1. When an instrument catches, partially withdraw and slightly rotate it, pushing it forward while making the rotatory movement. This device rarely fails in finally engaging the instrument in the orifice of the stricture, especially if the filiform point be bent or twisted in any direction (spiral or zigzag), so that its extremity may lie outside of the axis of the shaft of the instrument.

2. A popular method of finding the orifice of a stricture consists in cramming the urethra full of filiform bougies, engaging their points in all the lacunæ and false passages, and then trying them, one after another, until that one is pushed forward which is presenting at the orifice of the stricture, when it will at once engage. We have not had much success with this method.

3. If the point of the filiform passes the stricture, but catches in the prostatic urethra, it may be lifted into the bladder by a finger introduced into the rectum.

4. If the stricture is a single band, the face of which may be reached by the urethroscope, this instrument is introduced, the stricture wiped with adrenalin until it ceases to bleed, and a filiform then introduced, guided by direct ocular observation. This maneuver rarely succeeds where other means fail.

If the filiform is introduced only after long and persevering effort, the question arises whether one may let the patient go after dilating the

[10] The tunneled sounds, devised by Caples, may sometimes be introduced over filiforms when others cannot, due to the fact that the tunnel pierces the entire sound. This does away with the sharp angle between filiform and sound, which is usually encountered when a very small size of the ordinary tunneled sound is used.

stricture to 10 or 12 F., or whether it is preferable to tie in a filiform for two or three days until the next instrumentation (in which case the patient should remain in bed), or whether immediate perineal section should be done. As a rule, the first course is safer. But complicated cases may require one or the other alternative, especially since a single success in passing a stricture by no means implies that one will ever get through it again.

After the successful introduction of the filiform and dilatation, this should be repeated every third or fourth day until the stricture is sufficiently dilated to take woven bougies in increasing sizes.

Treatment of Retention.—Acute retention of urine from stricture may usually be relieved by the passage of a filiform, followed by a tunneled or guided catheter, as described in the preceding section. Two difficulties may arise in this connection: either the stricture may prove impassable or the retention, when once relieved, may recur. The treatment of impassable stricture is described in the succeeding section. Recurring retention is exceedingly annoying, and may continue until the stricture has been dilated as high as 20 F. In such cases, even though the recurrence of retention is obviously due to a marked congestive tendency, it is our practice to push dilatation very rapidly up to 20 or 22 F., reaching this in two or three sessions at three or four-day intervals. After this dilatation is attained, one may go more slowly, since the possibility of retention has been overcome.

Treatment of Impassable Stricture without Retention.—The treatment of this condition exercises the judgment of the surgeon as to how long he may coax the stricture in the hope of introducing a filiform through it without undue risk to the patient. The various renal function tests, notably the phenolsulphonephthalein test, are of great value in this connection. If the patient is afebrile, and the renal function is good, one makes many efforts before giving up and having recourse to perineal urethrotomy. But if the patient has chills or if the kidney function is bad, urethrotomy should be performed at once, and although external urethrotomy without a guide is a difficult and dangerous operation in unskilled hands, it is to be remembered that the skillful surgeon can offer much more brilliant hopes of recovery with this than by indefinitely prolonged efforts to get through an impassable stricture.

Treatment of Impassable Stricture with Retention.—In this condition the emergency is acute. The patient must be relieved immediately. If filiforms fail to pass, the patient may be put in a hot sitz bath at a temperature of about 100° F., and the hot water kept running so that the temperature is gradually increased as much as the patient can bear. This bath is continued for about ten minutes. If it causes faintness and nausea, it is all the more likely to cause relaxation. The patient is urged to try to urinate in the bath. Immediately after the bath he is put to

bed with hot blankets about him, and again urged to urinate. If this treatment fails the bladder should be aspirated above the pubes. This may be repeated several times. Yet suprapubic aspiration is only an emergency method, and if within twelve or twenty-four hours it is not followed by sufficient relief of congestion on the surface of the stricture to admit the passage of the instruments, the patient should be cut in the perineum.

Treatment of Traumatic and Other Resilient Strictures.—Traumatic strictures are almost invariably resilient, that is, they either refuse to dilate or, once dilated, promptly recontract. Resilient stricture (whether traumatic or not), if anterior to the penoscrotal angle, should be cut to 32 or 34 F. with the Otis or Maisonneuve urethrotome. If posterior to this point, such strictures should be resected, for, if they are simply cut, they are likely to reconstruct quite as badly as ever. The two best resection operations are those of Pasteau and Cabot.

Treatment of Inodular or Indurated Stricture.—Strictures complicated by lesions of scar tissue in and about the urethra require resecting after the scar tissue has been cut away.

Treatment of Irritable Stricture.—By irritable stricture is meant that type of stricture the treatment of which by sounds is followed by chills, acute urethritis, or bleeding. The bleeding may arise from the stricture, but the local or inflammatory reaction always, and the bleeding usually, are due to inflammation behind the stricture, generally in the form of prostatitis. Under such circumstances, if the stricture is not so tight as to prohibit delay, it is better to treat the patient first by hexamethylenamin and rectal injections, followed by gentle but persistent prostatic massage; next by instillations of silver nitrate, then to resume again the gentle passage of sounds. If, in spite of all this, the reaction reappears, perineal section should be done at once.

Treatment of Stricture Complicated by False Passage.—If a false passage has been made in the effort to get by a stricture, and the patient's condition permits, no further instrument should be passed for two weeks. At the end of that time sounding may be gently resumed, with the hope that the false passage has healed. But, if the stricture requires immediate dilatation, false passage may make the stricture an impassable one, to be treated as above described, while, if there are chills or other complications, these require prompt perineal section. In avoiding an old false passage it is necessary to locate its orifice first by noting in which direction the sound is deflected as it enters this. Having noted this, attempts at dilatation are subsequently made with the point of the instrument deflected away from the orifice of the false passage. False passages on the roof of the canal are so uncommon that it is almost a universal rule that they may be avoided by hugging the roof of the urethra with the point of the instrument.

Stricture Complicated by Periurethritis—Abscess or Infiltration.—The presence of any periurethral abscess, deeper than the penoscrotal angle, or of prostatic abscess, or urinary infiltration, calls for perineal section with evacuation of all pockets, free incision, and drainage and division of the stricture.

Treatment of Stricture Complicated by Acute Pyelonephritis.—The kidney must be drained either by a retained catheter or by perineal section. The tube should remain in place until the temperature touches normal. This failing, nephrotomy is required.

Treatment of Stricture Complicated by Fistula.—The chief aim in the treatment of fistula is to remove the impediment to urination—in most cases to dilate the stricture. This done, the fistula will usually close itself; but, as long as the urethra is obstructed, the urine will seek the freest outlet, namely, the fistula.

Indurated fistula is usually associated with resilient or impassable stricture. To cure it, all the scar tissue about the fistula and the urethra must be excised and external urethrotomy performed.

POSTGONORRHEAL NEUROSES

Two types of neuroses may result from gonorrhea. These are: sexual neuroses and painful neuroses.

Precisely the same types of neuroses are seen in persons who never had gonorrhea, and, whether following gonorrhea or not, their pathological basis consists in inflammation of the whole posterior urethra, or of the prostatic utricle alone, hypertrophy of the verumontanum, chronic prostatitis, or chronic seminal vesiculitis. Furthermore, there is in each case a psychic element of greater or less importance, and, finally, the pain may be falsely attributed to lesions in or about the posterior urethra, when it is actually due to neurosis or to one of the forms of intestinal indigestion commonly associated with indicanuria.

Therefore, before beginning treatment, all these elements of the case must be carefully studied, especial attention being paid to the neurotic element, for, in many instances, it will be found that fear of grave disease is the chief element in the case and the patient only requires to be reassured in order to be willing to put up with the mild inconvenience of which he complains. In other instances, treatment of the digestive disturbance will relieve the pain; in others, general hygiene will succeed, and, finally, a large proportion of the patients who complain of feeble erection and premature ejaculation require for their cure rather a study of their peculiar sexual aberration than any local treatment.

There still remain many cases, however, whom this treatment fails to relieve. For most of these cases more can be done by treatment of the

verumontanum through the posterior urethroscope than by any other form of local treatment. The straight tube may be used (the Geiringer or Buerger type). Through this, applications of 20 per cent silver nitrate or the undiluted acid nitrate of mercury are made once in ten days. The application may be made on a very fine cotton swab directly to the verumontanum, or on a large swab and followed by salt solutions to prevent excessive irritations. For similar cases Dr. Geraghty has obtained good results by injecting a few drops of 1 per cent silver nitrate into the utricle by means of a special urethroscopic syringe.

Oversensitive patients may be made distinctly worse by these methods of treatment, and for them the gentle passage of sounds and the employment of instillations of nitrate of silver are more satisfactory. Exceptionally, prostatic massage by the finger, or by a vibratory massage instrument introduced into the rectum, or by the galvanic or high-frequency current are of use. But, as a rule, the effect of such treatment is suggestive rather than physical, and, first, last, and all the time, sexual and general hygiene must be borne in mind.

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CHAPTER II

THE NON-SURGICAL TREATMENT OF GONORRHEA IN THE FEMALE

GUY L. HUNNER

Gonorrhea in the female should be considered a non-surgical disease. As is the case, however, with many other diseases usually controlled by medical procedures, the complications of gonorrhea may call for radical surgery.

The typical case of gonorrhea in the female comes on acutely with a catarrhal inflammation of the cervical, vaginal and vulvar mucosa which tends to be self-limited and to heal within a few weeks.

Owing to ignorance or diffidence the patient too often fails to seek advice for the early symptoms of a gonorrhea, or, even if she does so, the physician too often fails to make an examination; and the disease, which in the acute stage could be easily controlled, passes into the chronic form with its many complications, from which a complete cure becomes a matter of grave difficulty if not an impossibility.

Symptoms and Diagnosis.—The sudden onset of an inflammation of the mucous membranes of the external genitalia with burning, pain and excessive leukorrheal discharge are the common symptoms calling for a careful microscopic examination of the vaginal and cervical secretions.

If the examination is made in the acute stage one rarely hesitates to make a diagnosis from a glass-slide smear stained with methylene-blue solution, for the great number of the biscuit-shaped diplococci occurring in pairs, tetrads, and larger groups, and particularly the presence of large numbers of leukocytes, many of them packed with these diplococci, could be significant of no other condition.

In the subacute and chronic stages of the disease, however, in which the typical signs and symptoms may have almost entirely disappeared, one must often resort to Gram's method of differential staining, and the uncertainties of the picture may make a positive diagnosis impossible. And it is just in the chronic stage of the disease that our diagnostic ability is most often put to the test. The orthopedist wishes to know whether a chronic arthritis has its origin in a gonorrheal infection. In

medicolegal cases, particularly those of the divorce courts, we are asked whether the woman has had a gonorrheal infection. In the case of a known infection which has been treated we are asked whether the patient can safely resume sexual relations, or whether the unmarried woman is fit for a prospective marriage.

In the case of a pelvic inflammatory process of uncertain origin, we are called upon to decide whether it is puerperal in origin and, if so, what organism is concerned; whether it is a chronic tuberculous process; whether it represents a direct extension from a past appendicitis attack, or a blood-borne infection from some distant focus such as a tonsillitis, sinusitis or influenzal infection; or whether it follows a gonorrheal cervicitis. We can often derive more valuable evidence from a carefully taken clinical history and from the examination of the external and internal genital tracts than from our glass-slide preparations, and yet we hesitate to make a definite diagnosis of a gonorrheal process without the demonstration of the gonococcus.

How shall we isolate and demonstrate the elusive organism in these uncertain cases? In the comprehensive article by Norris and Mickelberg on the "Diagnosis of Gonorrhea in the Female by Staining Methods," they emphasize the difficulties of demonstrating the organism in a large percentage of the chronic cases, and give valuable directions for the taking of the specimens. Instead of the usual methods of taking the smear with a metal instrument or a dry cotton pledget, they advise the use of a pipet or medicine dropper, the glass nozzle of which has been drawn out into a fairly coarse capillary tube 6 to 8 cm. in length.

In addition to the advantage of being able to take up the exact drop of secretion one wishes on the slide, the pipet insures the spreading of the drop without crushing the leukocytes and thus making extracellular organisms of those that were intracellular. The dry cotton swab is likely to enmesh the solids of the secretion so that they fail to get over to the slide, and in rubbing the dry pledget over the slide there is danger of breaking up the leukocytes.

For the examination of children in the chronic stage they recommend the use of vaginal washings.

"The hips of the child should be elevated. A soft rubber eye syringe is partly filled with a weak mercuric chlorid solution and the tip is introduced through the hymen; the solution is then sucked in and forced out a number of times. At the same time the nozzle is moved around in the vagina in an effort to dislodge any particles of discharge that may be adherent to the vaginal walls. The washings are then centrifuged at slow speed and the sediment is examined. By this method the operator is enabled to secure all the discharge that is present; it is also particularly useful in chronic cases in which there is little discharge, and in determining when a cure has been effected."

The time-consuming element in this method is a disadvantage and they recommend that one first use the pipet method or a wet cotton swab soaked in a weak bichlorid solution. The wet swab method is rapid and easy and the solution is readily pressed out upon the slide, carrying with it the solid particles.

Norris recommends a preliminary slight traumatization of a suspected area with a 10 per cent silver nitrate solution, or, in the case of the cervix, with the solid stick, in order to produce more inflammation and thus increase the amount of the discharge and bring out the gonococci. The slide preparation should be obtained in from twelve to twenty hours after this artificial trauma.

These authors emphasize the probable differences in strains of gonococci in their reaction to staining and decolorizing methods. They believe that in questionable cases the staining should be done by experts, and that definite conclusions cannot be drawn from one or a few negative slides. They quote Findley's experience with isolated cases in which the gonococcus was found only after the eighth to the fifteenth successive daily examination.

We may take it for granted that every physician is aware of the importance in these questionable chronic cases of getting the secretions from some of the deeper glands; from within the cervix after massage, or from within Skene's glands after massage of the urethra, or from Bartholin's glands after compression with the thumb and finger. A rough-surfaced platinum wire is often serviceable for dipping into a Bartholin's gland.

In female children I find the best method for getting a cervical specimen is to place the patient in the knee-breast posture. Then, by working through a Kelly cystoscope, with head mirror reflected illumination, the secretion can be taken from the cervical orifice on the rough wire or on the wet cotton pledget twisted on the rough wire, or in the grasp of the alligator forceps.

We have attempted to portray some of the difficulties attending our older and more common methods of diagnosis. The question arises whether some of the newer methods have not been perfected to such an extent that we may now regard their adoption as simpler and more certain for diagnostic use.

Among the more promising methods we may mention the complement-fixation test, the precipitin reaction, and vaccine injections. Of these the first two are the most important.

The complement-fixation test and the precipitin reaction are based upon reactions produced by immune antibodies. The complement-fixation test is carried out on the principle of the Wassermann reaction. The antigen is made of gonococci; the blood-serum of the patient who is suspected of having gonorrhea is the unknown quantity and is tested against the known gonococcal antigen. This test was first elaborated by Müller and

Oppenheim in 1906. In America it was first carried out by Meakins in 1907. Since then it has been tried repeatedly in many institutions. In the hands of those who are most practiced in its performance and who by experience have perfected a uniform technic, this test has found enthusiastic favor and its results are said to be comparable to those of the Wassermann reaction in syphilis. Kolmer states that it has been found particularly valuable in arthritis, pyosalpinx and all forms of chronic infection, the so-called "closed" lesions of gonorrhea.

The principle of the precipitin reaction is just the reverse of the complement-fixation test. In it the blood-serum of an animal which has been immunized against gonorrhea is tested against the unknown secretions of the patient, vaginal, urethral, cervical or tubal, in which the presence of gonococci is suspected. As may be seen, this test can be performed only in those cases in which one can obtain discharges from the suspected lesion. In 1920, Robinson and Meader reported most encouraging accounts of their experience with this method. They found that the test was specific, would detect the gonococcus in cervical, vaginal and urethral discharges in the presence of mixed infections, and that it was positive also in many cases in which gonorrhea had been diagnosed clinically but in which all other laboratory methods of detecting the presence of the organism had failed.

As can be seen, these two methods supplement each other: the complement-fixation test in all chronic cases of "closed" gonorrhea, the precipitin reaction in those cases which present open lesions from which discharges can be collected. On paper, this program is ideal and covers practically all the clinical manifestations of gonorrhea, and, if it worked, would enable us to regard the question of the diagnosis of gonorrhea as a solved problem.

Unfortunately, several difficulties complicate the situation. In the first place, these tests can be carried out only in well-equipped laboratories and by highly specialized technicians. In the second place, the reactions by which these tests are determined are so delicate and so weak that even in expert hands the results have varied and have been unreliable. This is true particularly of the complement-fixation test. The reason for this is that in gonorrhea the organisms very rarely invade the blood-stream in sufficient numbers to awaken a marked antibody reaction; in the vast majority of cases the lesions of gonorrhea remain localized. In syphilis, on the other hand, the spirochetes invade the circulatory system at an early date, lesions bearing these organisms spring up in the most remote parts of the body, and the reaction of the blood in the production of immunizing antibodies is intense. Since the complement-fixation test is based upon the detection of these antibodies, this reaction in gonorrhea is almost always weak and equivocal, whereas in syphilis it is strong and usually characteristic.

For these reasons these tests have failed as yet to meet the requirements of everyday practice. The results obtained, however, are so promising that all such efforts should meet our hearty support and encouragement.

General Treatment.—Much work has been done recently in the elaboration of new methods of treating gonorrhea, particularly by vaccine therapy and by the use of anilin dyes. Vaccine therapy has its most ardent supporters in Europe, particularly in France, where it has been found especially beneficial in treating chronic cases, particularly the arthritic lesions. Good results have also been reported in the vaccine treatment of vulvovaginitis in children. This method of treating gonorrhea, however, has not proved to be as satisfactory as might be desired and, when used, must always be supplemented by active treatment of the local lesions by the approved older methods.

The late war gave a great impetus to the medical use of dyes, not only in battle wounds but also in civil practice. The most important of these dyes are acriflavine and proflavine. It has been found both by English and American investigators that acriflavine is one of the most powerful urinary antiseptics and is not toxic. Its clinical application has heretofore been limited to the treatment of the local lesions by direct application. There are possibilities that it may prove of inestimable value in the disinfection of urine and the treatment of gonorrheal cystitis and chronic urinary infections by oral administration. Recently, also, Young's 220, 253, and other antiseptics have been added to our armamentarium and may prove of value. The ideal urinary antiseptic, however—one which is colorless and does not stain clothing and dressings, is highly diffusible and will penetrate deep into mucous membranes without being too irritating, is highly bactericidal, is also non-toxic and inexpensive—has not yet been discovered.

It will be seen from the above discussion that the average physician is still dependent in large measure on the older methods for his control of this serious disease.

Rest in Bed.—We have stated that there is a tendency in gonorrhea to self-limitation and recovery within a few weeks. With the wider diffusion of knowledge concerning the venereal diseases, it is the rule to-day for women to seek professional advice as soon as they notice the appearance of any unusual genital discharge. If the physician will take advantage of this fact and always make a systematic examination including the microscopic test of the secretions there will be far less morbidity from neglected gonorrheal infections.

There is probably no one factor so important in the early abortion of an acute gonorrheal infection as rest in bed.

In acute infections of practically all other organs rest is the first prescription enjoined by the physician, but for various reasons the patient

with an acute gonorrhea is allowed to follow her usual daily routine. To advise a patient to remain in bed, to forbid sexual intercourse, and to warn against the dangers of transmitted infection, particularly for female children in the home, is usually equivalent, in these days of popular knowledge, to telling the patient the nature of her trouble. One does not necessarily reveal the true nature of the patient's inflammation, but it is a question whether the best results are not obtained, in most cases where suspicion is aroused, by having a family conclave with all cards laid on the table. By this method better coöperation is obtained from all those immediately concerned and much morbidity so often following the local infection is averted.

If the woman's social or industrial status is such that she cannot well spend the necessary two or three weeks in bed until the acute fulminating stage is controlled, the next best course is to see that she gets the utmost possible freedom from physical exertion, and if possible goes to bed for the period of her first succeeding premenstrual and menstrual epoch. It is well recognized that ascending infections are prone to occur during the menstrual period.

Local Medical Treatment.—Our active treatment in the acute stage is chiefly aimed at keeping the inflamed mucous surfaces free from accumulated infection and in as healthy a state as possible. Douches of a strength that would not irritate the mucous membranes of a healthy individual, or of a patient who has entered on the chronic stage, may be distinctly harmful in the acute inflammatory stages. It is a question whether the employment of copious and frequent irrigations with simple warm water, salt solution, or weak sodium bicarbonate solutions, is not better, in the acute stages, than to run the risk of irritating the mucous membranes with the hot antiseptic douches desirable in the chronic stages. Our best illustration of the value of such simple treatment is seen in the short-lived course of an acute gonorrheal infection of the mucous membranes of the female bladder, where, without other treatment than the thorough flushing obtained by the free ingestion of water, the gonococci usually disappear within from one to three weeks.

In the subacute and chronic stages, after the disappearance of the more acute inflammation and edema of the vaginal and vulvar mucous membranes, the treatment consists in the use of various antiseptics, either by the method of irrigations, local applications, and tampons, or by a combination of these methods. In these later stages the problem becomes one of reaching and destroying the organisms which have become entrenched in the deeper glandular recesses of the cervix, urethra and vulvovaginal region, and the treatment usually consists in the coöperative efforts by which the ambulatory patient keeps herself as clean as possible by the use of antiseptic douches and visits the physician at suitable intervals for his more drastic efforts to reach the deeper-seated organisms. The favorite

antiseptic douches are in general the pulvis antisepticus compositus of the pharmacopeia, solutions of mercury, potassium permanganate, silver, formaldehyd, carbolic acid, etc.; and most workers finally adopt one or two of these drugs as routine measures, finding by experience what strength of solution is best suited to the individual patient at different stages of the disease.

We must consider such problems as the age of the patient, the stage of the disease, the qualities of tissue (the blond patient having more tender mucous membranes than the brunette), the expense to the patient, the ease of preparation of the douche, and the freedom from staining of the clothing and toilet accessories.

As long as there is an appreciable amount of discharge I usually have the patient take two douches a day, using 2 quarts of hot water for each douche, 1 of these being prepared with the antiseptic powder, 1 or 2 teaspoonsful to the quart, and the other with the bichlorid of mercury in strengths of from 1 : 20,000 to 1 : 10,000.

The accessory treatment by the physician in his office or clinic, aimed at the destruction of the gonococci which have lodged in the glandular structures, varies with the stage of the disease and the experience of the physician.

Many clinics are reporting excellent results with the local use of the anilin dyes. Of the older methods, painting with the official tincture of iodin solution, swabbing with various strengths of silver nitrate solution, or the use of the lunar caustic, and carbolic acid up to full strength solutions are some of the more common practices.

Massage of the cervix, and of Skene's and Bartholin's glands is a helpful method in certain stages. By keeping the ducts of the deeper glands open and introducing antiseptics on the silver probe, or the rough platinum wire, or by means of a syringe with blunt needle point, one can often clean up the last vestiges of a chronic infection.

Tampons of glycerin or boroglycerin carrying 10 per cent of ichthyol are a decided help in some cases of chronic cervicitis.

In the chronic cervicitis that has resisted the above methods of treatment we have to consider more radical measures. If the patient needs a pelvic operation for other lesions, it is well to remove as much of the gland-bearing portion of the cervix as one thinks compatible with a possible future pregnancy. If no other operation is called for, the more conservative plan is to destroy the cervical glands by the repeated use of the actual cautery. This can be accomplished by office treatments without the use of an anesthetic, as described by the author in former publications. Such radical measures as amputation of the cervix or the use of the actual cautery should not be applied before the gonorrheal cervicitis has existed for at least six months, nor until the less radical measures have failed

to cure the leukorrhea; for one runs the risk of stirring up a fresh infection which may extend to the endometrium and fallopian tubes.

The local treatment of chronic gonorrheal lesions about the vulva and urethra is somewhat painful, but satisfactory anesthesia can be obtained by soaking a cotton pledget in 10 per cent cocain or novocain and applying this to the tender tissues for about five minutes before applying the strong antiseptics.

For the deeper-seated infections in the paraurethral glands, Skene's and Bartholin's glands, minor surgery is sometimes demanded and those interested in this phase of the subject are referred to a former publication.

Gonorrheal Endometritis.—A true gonorrheal endometritis is rare, probably because of the good drainage usually afforded by the uterus. When present, it usually follows an infection associated with an abortion or childbirth. Kelly states:

"Out of 1,800 cases occurring in my own service and analyzed by Dr. T. S. Cullen, endometritis showing definite inflammatory changes, exclusive of tuberculosis, was found only 49 times."

Gonorrheal Salpingitis.—To the house surgeon and intern familiar with gonorrheal pus tubes as seen in dispensary practice there is still too great a tendency to consider this disease as surgical, in spite of the excellent work by Simpson showing that the average patient with acute gonorrheal pus tubes does far better when treated by medical procedures (including strict rest in bed) than when dealt with surgically.

Gonorrheal General Peritonitis.—Without an exploratory laparotomy it is difficult at times to say whether a patient is suffering from a widespread pelvic peritonitis or a general peritonitis, but I believe the latter condition to be of fairly common occurrence and that its victims usually have a spontaneous recovery regardless of whether their malady has a correct diagnosis. Hunner and Harris reviewed this subject, gathering 32 cases from the literature and adding 7 cases from the records of the Johns Hopkins Hospital in which the evidence seemed to warrant the diagnosis of general peritonitis due to the gonococcus. Our conclusion from that study was that "surgical measures in gonorrheal peritonitis are of doubtful value." After a moderately large experience with this disease since that publication, I have seen no reason to alter that conclusion.

The chief justification for operating on a case of gonorrheal peritonitis is the failure to make a reasonably certain diagnosis. Viewed purely from the peritoneal symptoms one would not dare risk a diagnosis between gonorrheal and other forms of peritonitis, although the picture of an unusually acute and stormy onset, often followed within from twenty-four to forty-eight hours by signs of distinct improvement, is one suggestive of gonorrheal origin. With such a picture and the history of a blenorrhea of recent date or long standing, and the discovery of gonococci in the cervical, vaginal, urethral or glandular secretions, one should strongly sus-

pect a gonorrheal peritonitis. If there is a history of preceding pelvic pain and tenderness, and a mass can be felt in one, or preferably in both, ovarian regions, and especially if the peritonitis has occurred immediately after the manipulation of pus tubes, or during the menstrual period, or in the puerperium, the diagnosis is almost a matter of certainty. It requires courage on the part of the surgeon to lay aside the means which so often present the only hope in other forms of peritonitis and to pursue a course of "masterly inactivity" in the face of the fulminating symptoms so often present in gonorrheal peritonitis. The medical requirements are simple, consisting of good nursing, complete rest, practical starvation during the most acute stage, followed by restricted fluid diet until the bowels resume their natural peristalsis and the fever subsides, and the application of heat or ice over the abdomen. Cathartics are contra-indicated during the acute stage, but small enemata may assist in carrying off gas after peristalsis is restored.

The physician should not become stampeded if an otherwise smooth convalescence is punctuated with repeated temporary relapses, in which the patient has a return of abdominal pain and sudden peaks of temperature reaching 104° or 105° F. These relapses are usually of brief duration and probably represent fresh leaks from pus tubes, or the setting free of small foci of pus and infection from between the intestinal loops. Such recrudescences call for the resumption of the original line of treatment, namely, rest, starvation, local application of heat or cold, exclusion of cathartics, and use of enemata.

Systemic Gonorrheal Infection.—It is not within the province of this chapter to consider the widespread morbidity which may follow a systemic infection by the gonococcus. The mere enumeration of some of these lesions which will be discussed in other portions of these volumes emphasizes the truth of Osler's observation that "gonorrheal infection does not fall very far short of syphilis in importance." The patient may rapidly succumb to a general septicemia, or the disease may be prolonged with multiple pyemic foci, endocarditis, pericarditis, myocarditis, pleurisy, or cerebral complications. Arthritides are common, any or every part of the joint being involved, the cavity, the mucous membranes or the periosteum. The periarthritic tissues may be involved particularly as a tenosynovitis. Gonorrheal arthritic infections are too often characterized by excessive pain and obstinacy to treatment.

Gonorrhea in Female Children.—Every physician should remember the frightful susceptibility of female children to gonorrheal infection. The frequency with which children develop a vulvitis from infection by the colon bacillus, the Micrococcus catarrhalis, or some kindred organism, tends to make the physician careless about going into a minute examination in every case, and such an omission occasionally leads to surprising and bad results. To find that the mother and all other members of the

family are free from venereal infection is not sufficient. Too often an infected servant makes use of the washcloths or other toilet articles in the bathroom, or has intimate contact with the child in the superstitious belief that one can be rid of an infection by transferring it to a virgin.

Even with an early diagnosis in a child there seems to be a great tendency to chronicity of the infection, the organisms being recoverable even after a year or two. This may be due in large measure to our failure to insist on adequate treatment during the acute stage. It is difficult to enforce absolute rest for a child who seems perfectly well except for the local inflammatory process and, even if we succeed in keeping the child in bed, we may have great difficulty in gaining her confidence to the extent of having her submit quietly to adequate local treatment.

What has been said above about the dangers of using too strong antiseptics in the acute stage applies with special force in the case of the tender mucous membranes of children. Instead of the usual douching apparatus, some form of bulb syringe with a medium long and blunt glass nozzle is generally more satisfactory for vaginal irrigations and instillations in children.

Gonorrhea of the Urinary Tract.—Contrary to the usual teaching of textbooks gonorrheal cystitis is of common occurrence. This is particularly true in the female, owing to the shortness of the urethra and the ready extension of an inflammatory condition to the bladder. The intense bladder symptoms associated with many cases of acute gonorrheal infection have been ascribed to the acute urethritis, but a catheterized specimen of urine from the bladder in this stage of the disease will often furnish conclusive evidence of a cystitis by the presence of many pus cells filled with the typical organisms. In such cases I have often grown the gonococcus in pure culture on freshly prepared ascitic fluid agar slants.

Moreover, if one uses the cystoscope in these cases with acute bladder symptoms, as can be done in the female without the dangers attendant on a similar procedure in the male, the character of the cystitis may be studied. The gonococcus causes one of the few characteristically typical pictures with which the urologist has to deal. There is a general background of slightly congested mucosa. On this one finds anywhere from one to a dozen or more brilliantly red areas of congestion with numerous vessels converging in radial lines toward a central spot. The entire lesion will usually measure about 1 cm. in diameter, and the central spot, 3 to 5 mm. in diameter, may appear as an area of intense hyperemia, in which numerous fine vessels are seen; or the central spot may be of a solid deep red color, as if from a submucous hemorrhage; or there may be actual loss of the mucosa with fresh oozing of blood. Touching any of the more advanced-looking lesions with a cotton pledget causes bleeding, probably showing that there is a loss of surface epithelium. The intense redness of these local inflammatory areas often makes the general mucosa back-

ground appear paler white than normal, but this is due to the contrast, and careful inspection shows an increase in the number and size of the mucosal vessels in general.

An acute colon bacillus cystitis may present multiple brilliant red inflammatory areas on a background of comparatively normal-looking pale white mucosa; and at the first glance one may conclude that he is dealing with a gonorrheal cystitis. A more careful analysis of the picture, however, shows that in the acute colon bacillus cystitis the inflammatory areas differ markedly from the gonorrheal lesion. Instead of the small central spot of congestion toward which the delicate vessels converge like the spokes of a wheel, the area of congestion due to the colon bacillus presents a stippled or granular appearance and lacks the border zone of radiating vessels. It may cover about 1 cm., but is more often square or rectangular in form rather than circular, and the entire area presents a solid redness, in marked contrast to the wavy vascular border surrounding the minute central spot of the gonorrheal lesion. In the acute colon bacillus infection the general mucosal background is usually more vascular and therefore of a deeper red color than in the gonorrheal bladder.

The skilled urologist will have no difficulty, from the cystoscopic picture alone, in differentiating the gonorrheal from all other lesions of the bladder; but without the aid of a urologist the physician may easily arrive at the proper diagnosis. The history of a blenorrhea followed by severe acute bladder symptoms should always lead to the immediate taking of smears from the vaginal and urethral discharges, and it is not necessary to catheterize if one wishes to demonstrate pus and gonococci from the bladder. Careful sponging of the vestibule, blocking of the vaginal secretions with a dry cotton pledget, and examination of the last portion of the voided bladder urine gives one a fairly accurate estimate of the bladder condition.

A warning may not be out of place in this connection. When a recently married woman presents herself with the history of an acutely developing nuptial cystitis, do not jump at the conclusion that she has a gonorrheal infection. The excessive trauma that sometimes follows early married life may result in a colon bacillus urethritis which speedily results in a cystitis. I have seen 2 such cases in which there was lack of a history of gonorrhea in the husband, absence of gonococci in smears from the urethra, a pure culture of colon bacillus from the bladder, and the typical cystoscopic picture as outlined above of an acute colon bacillus infection.

Clinical Course of Gonorrheal Cystitis.—As suggested above, the acute gonorrheal invasion of the bladder is usually self-limited, and without treatment the gonococci and pus cells disappear from the bladder urine in from one to three weeks.

The patient may have failed to visit a physician during the acute

stage and at the end of two or three weeks her symptoms suddenly show such improvement that she decides she is getting well without medical aid. Too often the gonococci or their toxins establish a legacy of trigonitis or urethritis which continues to nag the patient with subacute bladder symptoms for an indefinite period.

It may be months, or even a year or two, after the acute onset before the patient consults a physician for her "kidney" or bladder trouble. With the foregoing history of the acute attack, one may find evidences about the external genitalia of a past gonorrhea, and the external urethral orifice and its surrounding glands and crypts may still show congestion. On the other hand, there may be a total lack of evidence about the vulva, and only by a careful urological examination does one find the probable cause of the persistent inconvenience.

The urine at this stage is quite negative or perhaps shows an abundance of squamous epithelium and mucin shreds pointing to a trigonitis. Cystoscopy reveals a trigonitis, a urethritis, or both.

Differential Diagnosis.—The chronic bladder symptoms following a gonorrheal infection should not present a serious problem to the urologist either from the viewpoint of diagnosis or of successful treatment. From the fact that the symptoms may be extremely annoying and persist indefinitely, if not properly treated, and because of the negative urinary findings, these patients in the past have often been neglected or improperly treated. The physician has been content to classify the condition, as well as similar symptoms due to other causes, as "irritable bladder" or "neurosis of the bladder" and to consign the patient to his list of "neurasthenics."

Recent urological investigations have brought to light various definite causes for these hitherto obscure conditions and we now see very few patients for whose "bladder symptoms" without a cystitis we cannot find the proper etiological classification and institute accurate and efficacious treatment.

Pathological kidney conditions sometimes causing serious bladder disturbances in the absence of a cystitis are tuberculosis, stone, and pyelitis of pyogenic origin. The urine in such cases usually contains pus, blood, albumin, bacteria or other abnormal elements and the conditions at once lead to a careful investigation which usually results in a prompt and accurate diagnosis.

On the other hand, the patient who is too often neglected is the one with chronic bladder symptoms whose urine is absolutely or so nearly normal that she fails to receive a thorough urological investigation. From this large group we may separate several important classes for proper diagnosis and treatment and we now have fair promise of practically doing away with the convenient but ambiguous classification of "neurosis."

The chief pathological conditions calling for this differential diagnosis

are: (1) trigonitis and urethritis due to past gonorrheal infection; (2) the same lesions due to focal infection; (3) the condition first described by the author as "simple" ulcer of the bladder and later designated "elusive" ulcer; (4) ureteral stricture; and (5) bladder symptoms resulting from the ingestion of foods to which the patient is sensitive.

Of the above groups of "irritable bladder" cases we are interested in this chapter in the differential diagnosis between the first two groups only. Urologists for many years have recognized the importance of gonorrhea as a cause of severe bladder symptoms due to a persistent chronic trigonitis or urethritis long after the original infection has seemed to be eradicated. They have recognized also a group of cases in which the identical picture of a chronic trigonitis and urethritis is found but in which gonorrheal infection can be positively excluded as the etiological factor. In my early work with Dr. Kelly we found that some of these patients had associated arthritic lesions, and that their urological condition sometimes answered favorably to antirheumatic treatment. We classified such cases as rheumatic urethritis.

In 1908 I had been treating for five months one of these chronic urethral infections, when the patient called my attention to the fact that after an application to her urethra of a 3 per cent silver nitrate solution she had an irritable throat for the remainder of the day, and after an application of a ten per cent solution of silver nitrate the urethra remained sore for two or three days, and at the same time she was much troubled with her throat. Investigation showed evidence of badly diseased tonsils. This patient had suffered for eight years with severe bladder symptoms, and for a year had been compelled to wear a pad because of incontinence. Five months of faithful urethral treatment had made very little impression on her symptoms. Within two months after tonsillectomy the patient returned for investigation and treatment on three occasions. Her bladder symptoms were gone, and the urethral mucous membranes, which up to the time of her tonsillectomy had remained granular, red and very sensitive, now appeared normal except for slight redness about the inner sphincter.

Similar experiences have occurred so often in the past fifteen years that I now place focal infections ahead of gonorrhea as a cause of chronic trigonitis and chronic urethritis.

A fact which I have often stressed and which has not yet been generally recognized by gynecologists is that focal infections may result in inflammatory conditions about the external genitalia which one cannot differentiate clinically from a chronic gonorrhea. The patient may present a cervicitis, vaginitis, vulvitis, ulcerations about the para-urethral crypts, and brilliant red points about the hymen which make the clinical picture identical with that of a gonorrhea. The most suggestive and most striking circumstances under which we see these conditions leading us to

scout a gonorrheal origin are in children and in spinsters, where the social conditions and clinical investigations practically exclude gonorrhea as a factor. To have these signs and symptoms disappear after proper care of the focal infection furnishes the final argument. Another therapeutic test which I have often found of value in the differential diagnosis is that the average case of gonorrheal trigonitis and urethritis usually clears up like magic under a few applications of the silver nitrate solutions (10 per cent to the trigonum and 3 per cent to the urethra), while similar lesions of a focal infection origin may clear up as promptly under the same treatment, only to return in a short time. The gonorrheal case may be extremely persistent if the suburethral glands of Luschka or Skene are harboring deep infection, but in such cases we usually have the typical past history of gonorrhea, and the final cure may depend on eradication of these glands.

We must not forget that both gonorrhea and focal infections are of common occurrence, and that a chronic gonorrheal trigonitis and urethritis may clear up under treatment, only to have the patient return months or years later with a seemingly identical condition, which does not respond to the usual treatment. In such cases we should investigate carefully for a possible focal infection origin.

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CHAPTER III

IMPOTENCE

EDWARD L. KEYES AND HOWARD S. JECK

Treatment of Organic Impotence.—Impotence may result from many congenital and acquired defects, such as hypospadias, tight urethral stricture, tabes, etc. Such impotence is, of course, only as curable as is its cause.

TREATMENT OF FUNCTIONAL IMPOTENCE

The treatment is threefold.

The Patient's Sexual Coefficient Must Be Discovered.—By the sexual coefficient is meant the amount of sexual power with which the patient is endowed by Nature. Mankind at large is possessed by the notion that, although men's noses and digestions need not all be cut of the same pattern, it is to be expected that the sexual capacity of every one should be all-embracing. Thus, while it is no disgrace to be dyspeptic about the stomach, it is to the last degree shameful to be dyspeptic about the genitals. Theoretically, such a distinction is absurd; but practically no man is willing to brand himself a sexual laggard.

In some way, by dint of enumerating emissions, copulations, masturbations, the physician must learn what ideal he can set before the patient. If a man has a natural sexual capacity for copulation only once a month, it is hopeless to try and tune him up to three times a week.

One of the greatest influences in deteriorating sexual powers that have already begun to weaken is the trick so readily learned by such individuals of having a premature ejaculation and, as soon as possible thereafter, cohabiting to their satisfaction. Such a practice inevitably leads in a few years to total impotence. Other violations of sexual common sense, such as withdrawal, are less certain to produce a like result.

The Patient Must Be Encouraged.—The first point of encouragement must be to depress him by bidding him look for a protracted and relapsing convalescence. Then he must be made to understand that his sexual

possibilities are just so great and no greater; and that, however well he may get, overstepping his allotted bounds will call down swift retribution upon him. Finally, he must really be encouraged to feel that his malady is a functional disorder, a dyspepsia, which, like other dyspepsias, is curable, but only at the cost of a prolonged fast. He must abstain from coitus, from masturbation, from lewd companions, from obscene thoughts and things. The more thoroughly he abstains the more certain his cure. Usually he will try to adopt halfway measures, caring more for his "pot of ale" than for body and soul together. But such a course may not be countenanced. The ideal of absolute purity must be forever set before him, and, as it were, hammered into him.

He Must Be Assisted Physically.—When possible, an entire change of scene presents the best opportunity for a man to get out of his old rut. Nothing could be better than a hunting or fishing trip. But, if this is impossible, tonics may be given him, and sounds, nitrate-of-silver applications, rectal douches, according to the choice of the physician. To some hyperesthetic individuals massage of the vesicles is so nearly a suggestion of the sexual act that we fear it is quite as likely to do harm as good. If a strong moral influence, as that of father, brother, or priest, can be brought to bear, so much the better.

But all these measures are frankly palliative. When a man has once got into the habit of concentrating his whole mind upon his sexual organs it is not to be expected that he should be entirely diverted to higher things. Chastity all can aim at, but celibacy is beyond the reach, beyond even the understanding, of the many. Hence, the proper cure for such a man, if he can be got into such a condition that he has an erection ever so rarely, is to instruct him in sexual physiology and hygiene, to acquire his confidence by sympathy, and to get him married, with the advice to attempt no intercourse, to be entirely frank and honest with his wife (who will more than equal him in timidity and ignorance) and, awaiting some morning when awaking with a vigorous erection, to accomplish coitus promptly, without delay, as a matter of imperious duty. The act once accomplished, the spell is broken. He knows he is a man, and his confidence in himself returns.

Local treatment by instillation, massage or urethroscope should be employed by each physician only in the measure in which he finds it successful, and with the recognition that it represents a small measure of counter-irritation with a large admixture of psychic impression both upon the physician and upon the patient.

CHAPTER IV

DISEASES OF THE PROSTATE

HUGH HAMPTON YOUNG

THE PROSTATIC EXAMINATION

The importance of prostatic examination with the finger through the rectum has never been sufficiently stressed in textbooks of medicine. In many institutions where a great pride is taken in the most elaborate and painstaking clinical examination, it is not rare to find that no prostatic examination has been made. Many years ago Dr. Osler called attention to the importance of these examinations and said tersely that "the difference between a good physician and a poor one was that a good one knew how to make an accurate rectal examination."

This importance is appreciated when it is realized that the prostate is one of the few organs which can be palpated from without, one of the very few in which the secretion can be obtained by pressure and examined under the microscope, and in which the interior can be carefully studied by urethroscope and cystoscope and the ducts within it (ejaculatory and utricular) can be injected with shadowgraph media and photographed by the X-ray. It is also one of the few internal organs which can be definitely treated with radium from four directions—through the skin, through the rectal wall, through the urethra and through the bladder. From the standpoint of the surgeon, it is an organ which is most successfully amenable to surgical treatment, not only in benign hypertrophy with its amazing cures in aged and infirm men, but also in cancer of the prostate in which the operative results are as good as for almost any other organ of the body, and for tuberculosis and chronic infections which are easily reached and eradicated without opening the urinary tract.

It is unquestionably most important for the internist and family doctor to recognize the diseases of the prostate and to know the possibilities of cure, because they are the ones who see these cases first, and, if they could be persuaded to include prostatic examinations in their routine physical examinations, many early cases of carcinoma, tuberculosis and septic foci would be recognized before they spread to other portions of the body.

Rectal Examination.—This is usually best done with the patient leaning forward with his elbows upon his knees (the "leapfrog" position). With the gloved or rubber-cotted finger introduced through the anal sphincter one notes first the condition of the rectal wall and then palpates the prostate in the median line. As shown in Figure 1 there is a notch at the upper end of the prostate in the median line and below that a median furrow. The tissues in this region are soft in normal cases. In hypertrophy the finger usually sinks between two lateral adenomatous lobes. In carcinoma one usually finds a very indurated, non-compressible area and in tuberculosis and in chronic prostatitis nodules, induration, etc., are made out. With finger in rectum and cystoscope in urethra the thickness and induration of the median, suburethral portion of the prostate is of importance in the diagnosis of cancer. On each side of the median line are the two lateral lobes, which measure about ¾ inch wide and 1¼ inches in length, the entire prostate measuring about 1½ inches in width and 1¼ inches in length. Each lateral lobe is rounded, generally elastic, smooth and neither adherent nor nodular. Pressure upon the lateral lobes forces from the gland ducts into the urethra the secretion of the glands and, when this has been done vigorously on each side, by stripping the prostatic urethra from behind forward in the median line, the fluid can be forced forward through the external sphincter and bulbous urethra, and gravity carries it downward out through the anterior urethra, where it can be caught at the meatus upon a slide for examination.

Fig. 1.—Rubber Stamp Diagram of the Prostate, Seminal Vesicles, Base of the Bladder, etc., as Felt per Rectum. If the abnormal features are sketched in with pencil or ink at the time of examination, this affords a permanent record of the findings.

If cultures are desired, it is generally well to prepare by retracting the foreskin, cleansing the glans with alcohol, injecting the anterior urethra with some antiseptic solution (1:500 meroxyl, 1:50,000 bichlorid of mercury, etc.), instructing the patient to urinate, and then catching the fluid which has been expressed from the prostate and forced along the urethra, as above described, in sterile test tubes from which cultures are made on prepared media and the remainder used for microscopic study.

Examination of the Adnexa of the Prostate.—After carefully examining the lateral lobes and possibly obtaining their secretion, one next turns his attention to the seminal vesicles and ampullæ of the vasa deferentia, which are bound together more or less loosely and irregularly by the fascia of Dénonvilliers above the prostate and against the posterior wall of the bladder. In all but very fat or very muscular subjects these structures are easily reached and palpated in their entire extent with the examining finger. The upper portions of the vesicles, when distended with secretion, appear as somewhat irregular, softly elastic, about the size of the index finger, and on pressure lose their shape much as a distended finger cot would when compressed. By gentle palpation the contour, irregularities, consistency, adhesions, etc., are easily made out. The ampullæ of the vasa deferentia are also often distended with fluid and are from ¼ to ½ inch in diameter. Rarely they can be distinctly palpated as separate fusiform tubes of distinctly denser consistence than the vesicles. In other cases they cannot be felt or are completely obscured by the overlapping vesicles. But induration in this region is often made out, frequently being associated with a perivesical plateau which extends across from one side of the pelvis to the other, presenting a concave upper border an inch or so above the superior edge of the prostate. The secretion from the seminal vesicles and from the ampullæ can be obtained, more or less separately, by careful pressure over these structures and vigorous downward stripping along the course of their evacuating terminal portions and the ejaculatory ducts, through which it escapes into the prostatic urethra. From thence it can be carried by pressure from above downward through the external sphincter out of the bulb into the pendulous anterior urethra, where by gravity it appears at the meatus as previously described.

Microscopic Examination of Fluids Obtained by Massage.—The fluid obtained by stripping, described above, simulates very closely in its contents the ejaculated semen, containing as it does the spermatozoa from the ampullæ, the mucous secretion from the seminal vesicles and the cellular and fluid contents of the prostatic glands. Unless great care is taken to obtain fluid from the different portions separately, as above described, the normal secretion, as usually obtained, contains spermatozoa which are generally actively motile, whorls of mucus from the seminal vesicles, lecithin cells, granule cells, small and large (some being of the large compound type), occasional epithelial cells, corpora amylacea which come from the prostatic gland ducts, and urethral cells of varied types. Red blood corpuscles and leukocytes are also sometimes present. The reaction of the fluid thus obtained is generally alkaline. When a thin film is made of the combined secretions and stained with a polychrome stain, the different character of the cells is brought out. All students and physicians should learn to recognize normal and abnormal prostatic secretion, and as it is an office test which can be carried out with great ease, this method

should be in general practice. It is not usually necessary to make more than an examination of a fresh drop of secretion on a slide, sometimes with the addition of a 1 per cent acetic acid to bring out the nuclei of the cells present. As will be pointed out later, the secretion quickly changes to a purulent character in chronic infections of the prostate, and in tuberculosis the bacilli can usually be obtained on a stained smear. In cases of sterility the spermatozoa may be absent or show lack of motility.

ACUTE GONORRHEAL PROSTATITIS

The prostate is involved in the gonorrheal processes in from 30 to 60 per cent of cases and forms one of the most important complications of the disease. The progress of the gonococcal infection is generally progressively upward, and the prostatic urethra, the ducts and glands of the prostate and the seminal vesicles become involved in the progress of the disease. Exposure to cold, injuries, trauma—such as from bicycle riding, etc.—have some effect in increasing the frequency of prostatic inflammations. The pathological process is so similar to the lesions produced by gonorrhea in the urethra that little mention will be necessary.

There is first the posterior urethritis, with swelling, congestion and inflammation of the mucous membrane, with the characteristic infiltration between the epithelial cells and into the submucosa. The acini of the prostate are involved, the extent of the process depending upon the depth of the invasion. It is sometimes slight and almost entirely periurethral, but often the entire prostate is involved and the interstitial tissue is invaded with the usual outpouring of leukocytes, round cells, etc. This process may go on to the formation of minute focal areas of suppuration in and between the acini; and even to abscesses, of small or large extent, which may completely fill the entire prostate. The abscess may rupture into the urethra or, passing through the fascia covering the prostate, may invade the periprostatic tissues, the space around the rectum, or the perineum; or passing forward may reach the prevesical space. If the pus travels upward, it may invade the space in and about the seminal vesicles back of the bladder and beneath the peritoneum, with the occasional formation of pelvic abscess, etc. Through the ejaculatory ducts, the seminal vesicles and ampullæ become involved, and here again the process may be slight or extensive, confined to these structures, or passing beyond into the tissues back of the bladder or beneath the fascia Dénonvilliers.

In the further progress of the disease the epididymis on one or both sides may be reached either directly by the vasa deferentia or through the lymphatics which extend from the region of the vesicles along the cord to the globus minor of the epididymis, which is the portion usually in-

volved. The testis is rarely involved, but an acute hydrocele and, rarely, abscess of the testis are seen.

In the majority of cases, the involvement of the prostate is not marked and when the disease disappears from the anterior urethra the patient often considers himself cured, when the prostatic acini still harbor the gonococcus.

Symptoms.—In the majority of cases of anterior and posterior urethritis slight involvement of the prostate produces no additional symptoms; the patient has burning on urination and perhaps slightly increased frequency and pain. If the process is more pronounced urination may become more frequent and very painful and sometimes is associated with marked spasm and violent contraction of the bladder and deep urethra as a result of concomitant involvement of the neck of the bladder and trigone. Rarely there is such pronounced strangury that the patient is in great pain, urination almost constant, and accompanied by bleeding. Where the prostate is markedly swollen, urination becomes more difficult, the stream small and frequent, the flow being hard to start and two or three efforts being necessary to complete the act. Residual urine is probably present in these cases and, if the obstruction becomes more pronounced, complete retention of urine may result with progressive distention of the bladder and pain. Radiating pains which reach the rectum, the perineum and end of the penis and which travel upward along the back or downward along the sciatic nerves are fairly frequent. In severe cases, fever, chills, sweats and great systemic disturbances occur; and, if the gonococci get into the circulation, gonorrheal septicemia, endocarditis, multiple involvement of joints, tendon sheaths, bursæ and in fact almost every tissue and region of the body may occur. The term "gonorrheal rheumatism" covers a great many of these complex clinical pictures and is an extremely dangerous disease.

Clinical Findings.—A urethral discharge may or may not be present, even in acute cases, which have a tendency to cure up externally as the infection passes upward. If a discharge is present, or pus cells can be obtained by smear from the urethra, gonococci may be diagnosed by their intracellular, biscuit-shaped, Gram-negative character. The patient should be instructed to void urine in three glasses, and the shreds, which are usually present, should be carefully examined for leukocytes and Gram-negative cocci. If the urethritis has cleared up, the first urine voided may show no shreds or evidence of inflammation or cocci, but in the third urine voided, as a rule, the inflammatory contents of the prostatic ducts are often squeezed out by the last act of micturition (the spasmodic muscular contracture which empties the vesical neck and prostatic urethra of its urinary contents). In such cases, one will recognize the typical comma shreds in the third urine, and when these are examined the leukocytes and cocci may be found. Not infrequently blood is squeezed

out in the spasmodic final effort of urination and appears in the third urine.

After examination of the external genitalia, especially the epididymis, the rectal examination as above described should be carried out. Where the disease is early or not extensive, nothing may be made out on gentle palpation. Where the process is more pronounced or older, swelling, induration or softening, periprostatic invasion, involvement of the seminal vesicles, ampullæ and surrounding tissues may be detected. In some cases the rectum is greatly compressed by a bulging sac of pus which may eventually break into it. In other cases, it may appear beneath the skin of the perineum and, as stated above, may often break into the urethra and appear in the urine or even at the meatus. More extensive involvements by the suppurative process may make their appearance perivesically or retrovesically, intraperitoneally or retroperitoneally. In many cases most careful regional examinations are required to make out the direction and extent of the invasion, but unfortunately the signs and symptoms are often so obscure and the patient so very sick that exact diagnosis is extremely difficult.

The examiner should be careful not to make violent pressure or traumatism with the finger upon the prostate and its adnexa in these acute inflammatory conditions and no intra-urethral instrumentation should be carried out unless urgently required. Where the obstruction to urination is very definite and a distended bladder can be palpated and percussed, relief may be required, but even so an intra-urethral instrumentation with its consequent traumatism should be avoided if possible.

Treatment.—Every patient with acute gonorrheal urethritis should be told that it is a serious disease, frequently accompanied with complications of grave moment which are often incurable. If possible, the patient should stop work, drink water in great abundance, so as to keep the urethra flushed, and take frequent mild antiseptic injections or irrigations, care being taken not to cause irritation or to force the infection upward. Light diet is indicated, but the effect of foods is a moot point. Rich, highly seasoned foods are contra-indicated. Internally, sandalwood oil or the citrate of potash and hyoscyamus mixture are valuable, but water in great abundance is probably better. Some patients are able to drink 10 or 12 quarts a day.

When the posterior urethra becomes involved the injection or irrigation should be carried back into the deep urethra and bladder. The method of Janet—intravesical irrigation of 1 : 6,000 permanganate of potash, forced in by hydraulic pressure—has been a standard treatment for thirty years. Acriflavine, 1 : 8,000, or meroxyl 1 : 1,000, as an irrigation; argyrol, 1 to 5 per cent, or mercurochrome, ¼ to 1 per cent, as an injection forced back into the deep urethra, are all valuable when frequently and cautiously administered. If there is much swelling or pain, sitz baths, hot

enemata, or two-way irrigations into the rectum, of either very hot water (110° F.) or iced water may be of great benefit. Where the obstruction to urination is great, a dose of morphia and irrigation of the anterior urethra may induce urination. Sometimes the patient will void in a hot tub of water when everything else has failed. If it becomes necessary to relieve the overdistended bladder, a small rubber catheter may be passed very gently after the use of procain 4 per cent in the urethra, or suprapubic aspiration of the bladder may be carried out. The latter procedure has the great advantage that no traumatism is done to the posterior urethra or prostate and often one aspiration will be sufficient to restore muscular tone and be followed by normal urination. In some cases I have aspirated several times. A needle about the size of the old-fashioned steel hatpin is inserted vertically, about ¾ inch back of the symphysis pubis, into the overdistended bladder. As the urine escapes the needle should be partially withdrawn so that it does not impinge upon the posterior wall.

ABSCESS OF THE PROSTATE

Where an abscess has formed and is not decreasing under the methods described above, some form of evacuation may be necessary. It is probably best to allow the abscess to break into the urethra if this is possible and some practitioners have advised rupturing the prostatic urethra with a sound, or some special instrument, to bring on intra-urethral drainage. Casper and others have advised puncturing the prostatic abscess through the rectum and claim no permanent rectal fistulæ result therefrom. I have, however, known such to occur and never employ this method, but prefer to make an incision through the perineum, such as one does for conservative perineal prostatectomy and, after dividing the central tendon, to expose the apex of the prostate and the posterior surfaces of the lateral lobes without opening the urethra. It is frequently possible to excise, evacuate and drain considerable abscess of the prostate without opening the urethral mucosa and without the formation of a urinary fistula. Where the suppurative process involves the seminal vesicles they may be reached and evacuated in the same way.

Prognosis.—The probability of a cure in gonorrheal prostatitis is not great. Most cases result in a chronic prostatitis and the gonorrheal infection is apt to persist for months or years. Not infrequently, when the gonococci disappear, other organisms, generally staphylococci or streptococci, are found and lead to grave lesions elsewhere. The prostatic ducts furnish poor drainage for the abundant glandular ramifications in the prostate, and the minute ejaculatory ducts give a small outlet to extensive suppurative processes in the ampullæ and seminal vesicles. It is not surprising, therefore, that these infections persist in the great majority

of cases and lead to grave urinary, sexual, neurological and systemic diseases.

The test of cure is not always simple. A gonorrhea should never be considered cured because the discharge at the anterior meatus is no longer present. Smears from the urethra and studies of the urine and the shreds in both the first and third glasses should be carefully made. Search for comma shreds from the prostatic ducts should be carried out. Rectal examination, accompanied by stripping of the vesicles and prostate and examination of fluid microscopically and by culture, as above described, should usually be insisted on before consent for matrimony is given. If such procedures were carried out in all cases, fearful infections of pelvic organs in women, acquired from husbands who considered themselves absolutely well, would be practically eliminated.

NON-GONORRHEAL PROSTATITIS

This condition usually gives so few symptoms that it is apt to go unrecognized until it has become a chronic affair. Bacteria may reach the prostate from various sources. They are eliminated, as we know, frequently with the urine in various inflammatory diseases of remote parts of the body, even tubercle bacilli being found in the urine occasionally in tuberculosis of the lungs. Bacteria may be carried to the prostate through the lymphatics from adjacent structures, such as the rectum, peritoneum, bladder and upward from the epididymis. In typhoid fever the not infrequent presence of bacilluria may lead to a prostatic involvement. The common infections of the nose, throat, sinuses, ear and gastro-intestinal tract are frequently responsible for infections of the prostate. The bacteria more commonly found are colon bacilli or staphylococci, but occasionally streptococci or diplococci and various other bacteria are obtained from slides and cultures. Pathological examination shows a low-grade inflammation, endoacinal and periacinal in character, with infiltration of the tissues in and about the prostate as well as involvement of the seminal vesicles and vasa deferentia. Occasionally the process goes on to abscess formation, as described above. Not infrequently cystitis is also present and occasionally non-specific urethritis with pus and shreds simulating a gonorrheal infection.

Clinical Findings.—The urine may contain leukocytes, shreds, blood and bacteria. On rectal examination, changes in the prostate similar to those produced by gonorrhea, and previously described, are present, and the prostatic secretion will show leukocytes and the infecting organism. Catheterism is usually unnecessary unless obstruction to urination is present and it may then be avoided by suprapubic aspiration.

Symptoms.—These are often slight and generally the condition passes into the chronic stage without attracting notice other than burning on

urination, or slight frequency of urination and a little pain. Rarely the symptoms are fulminating and associated with pain, difficulty of urination, or the formation of an abscess which may become extensive and involve adjacent structures. The treatment is similar to that suggested for acute gonorrheal prostatitis and abscesses should be evacuated as a rule, before metastatic processes to distant organs occur.

CHRONIC PROSTATITIS

This may be either of gonorrheal origin or due to other bacteria, and the process is very much the same in both. In many cases which begin with a gonorrheal infection the gonococcus dies out and eventually other organisms, staphylococci, streptococci and bacilli, take its place.

Pathology.—The pathological process in chronic prostatitis is very variable, depending on the extent and duration of the infection and the causative microörganism. The glandular changes are both endoacinal and periacinal, and the usual infiltration is seen with collections of round cells and even small localized abscesses. Fibrotic changes also occur which may lead to marked destruction of the glandular tissue. If the process has been very extensive, periprostatic infiltration and adhesions may be present. The seminal vesicles and ampullæ of the vasa deferentia are usually involved to a greater or lesser extent with similar changes both within and without. Not infrequently considerable collections of pus are present and in others there are marked adhesions to adjacent structures. Occasionally the disease travels up the vas or lymphatics of the vas and reaches the epididymis with resulting acute or chronic epididymitis, but rarely is the testicle involved. Within the urethra the changes are those of a chronic posterior urethritis—congestion of the mucous membrane, enlargement of the verumontanum—sometimes with granular or even polypoid surface changes. The utricle and ejaculatory ducts may be involved and strictures of these are occasionally seen with retention above them. In other cases a simple chronic infection is present.

At the vesical neck or internal prostatic orifice, one may find a chronic glandular infection, either suburethral or subvesical. In some cases the glandular changes are sufficient to cause distinct enlargement and swelling, resulting in the formation of a bar or small obstructing lobule. In other cases the inflammation becoming chronic leads to a fibrous contracture of the vesical orifice, involving largely the median portion or posterior bar; but in some cases it is characterized by a circular fibrosis of the entire prostatic orifice, which has been rightly called stricture or contracture of the neck of the bladder. These obstructive conditions are accompanied by changes in the bladder, trigone, ureters or kidneys, such as are seen with obstructive prostatic hypertrophy.

Symptoms.—These may be divided into the following types:

Urinary.—In most cases of simple non-obstructive chronic prostatitis, the urinary symptoms are slight and consist principally of irritation in the deep urethra, burning on urination and occasionally pain which may be of a dull aching character in the deep urethra or radiate from there to the perineum, rectum or to the end of the penis. In some cases the pain is more acute. It is very apt to be more pronounced at the end of urination, and is sometimes accompanied by bleeding. In more severe cases the pain may be distressing, and be of such a continuous nagging character as to cause the patient great discomfort and lead to much mental distress and severe neuroses and psychoses. When there is obstruction present urination is greatly altered, as in prostatic hypertrophy. One sees in the early cases only a slight hesitation and difficulty in urination. In the later cases residual urine may develop with reduction of the vesical capacity and may lead to progressively increasing frequency of urination. The obstruction may become so great as to lead to complete retention of urine and catheterism with the attending infection and other complications.

Sexual Changes.—These symptoms may be very pronounced but in most cases they are slight and may be characterized by a hyperexcitability or precocity of ejaculation, which in some cases may become so great as to occur immediately on entrance or even before. When the ejaculatory ducts are constricted (which is rare), ejaculation may be greatly diminished or even suppressed. Even slight changes in the sexual powers may lead to severe psychoses or lack of confidence with concomitant diminution of libido and impairment of erections. Sexual neurasthenia is one of the most common of masculine ailments and very serious in its consequences.

Referred Symptoms.—These form a most interesting complex in the clinical picture accompanying chronic prostatitis. One frequently sees pain referred to the other regions of the body, either to immediately adjacent structures, such as the rectum, perineum, penis and bladder, or to more remote regions, the back, hips, thighs and legs. Not infrequently the pain is referred to the region of the kidneys and occasionally it comes on in the form of a sharp pain or colic which may closely simulate renal calculus and, in rare instances, in which hematuria from congestion of the verumontanum is present, the clinical picture may be almost identical with that of nephrolithiasis. These referred pains, which may come either from nerve changes within or around the prostate and seminal vesicles, are due to chronic inflammatory infiltration and adhesions, and follow the laws of Head in regard to referred pains. The subject has been very completely treated in an article by Young, Geraghty and Stevens, and also in the articles by Dr. Thomas McCrae and Young. Suffice it to say here that symptoms of chronic prostatitis and vesiculitis are so complex and

often located so remote from the prostate that they present a very varied and puzzling clinical picture. Clinicians should suspect the prostate when vague pains and neurotic symptoms involving almost any portion of the body below the diaphragm are present, and careful examination of the prostate, vesicles and their secretion should be carried out. This will often clear up an otherwise inexplicable case.

Findings—*Urine.*—This is often negative, but not infrequently the usual accompaniments of a chronic posterior urethritis are found; shreds, which are apt to be of the small comma variety which are squeezed from the prostatic ducts in the final spasmodic act of micturition and appear only in the third glass of urine voided, are often present. More rarely one finds blood corpuscles and sometimes frank bleeding. Chronic cystitis with the usual cellular and bacterial changes are not infrequently seen.

Rectal Examination.—This will usually reveal changes in the prostate which can be easily made out by the palpating finger and vary from slight to extensive induration or nodulation and adhesions. Sometimes a definite enlargement of the prostate is present. Similar changes are found in the seminal vesicles and vasa deferentia and, if the inflammatory process is extensive, a broad plateau of induration above the prostate completely surrounding the vesicles and vasa deferentia and extending from one side of the pelvis to the other is found. A common picture is that of a slightly irregular prostate, indurated in places, with adhesions and similar changes in the seminal vesicles. Marked tenderness is not usually present, but in rare cases may be very pronounced. The secretion obtained by massage of the prostate will usually show the presence of pus cells and occasionally bacteria. In some cases the fluid obtained is entirely composed of pus cells, but in most instances lecithin cells, compound granular cells, spermatozoa and other normal constituents are found. When pressure is made directly upon the seminal vesicles large whorls of typical mucus from the seminal vesicles are seen. As remarked before, by stripping only one portion of the prostate or one seminal vesicle selective diagnosis of the conditions present in the different portions may be made out.

By means of cultures it is possible to get accurate information as to the type of organism present. The technic of this has been described at the beginning of this article. In a long series of cases it has been surprising to find the cultures negative in the majority of cases, even in cases when remote rheumatoid and arthritic conditions indicate a chronic infection. In some of these cases at operation, cultures taken from the tissues removed have shown streptococci and in others diplococci and staphylococci. In order to grow the gonococcus we usually employ serum agar slants corked with rubber stoppers after passing the tube through a flame which expels some of the air, thus reducing the amount of oxygen and giving an excellent culture medium for the gonococcus, as

shown by the work of Swartz. This medium makes a most simple and successful method of gonococcus culture.

Bladder Examinations.—These are indicated only when urinary changes are present. By means of the cystoscope the presence of inflammatory contracture or bars at the neck of the bladder can be made out and residual urine or contracture of the bladder can be determined. The cystoscope may also reveal trabeculation, cellule and diverticulum formation, hypertrophy of the trigone, cystitis, ulceration and other changes which occur in complicated cases. With the finger in the rectum and cystoscope in the urethra, an increase in the median portion of the prostate and an indurated collar around the shaft of the instrument are indicative of pronounced changes at the vesical neck which often require operation.

Changes.—Scrotal changes, such as epididymitis, induration of the vas deferens, hydrocele, etc., are not infrequently present and may be associated with marked tenderness or hyperæsthesia.

Diagnosis.—When the symptoms are localized to the region of the prostate the diagnosis may lie between simple or tuberculous prostatitis, calculus of the prostate, hypertrophy or carcinoma.

In tuberculosis the lesions are usually more pronounced and tubercle bacilli may be found in the urine or in the expressed prostatic secretion. In many cases, however, the changes in the prostate and seminal vesicles in tuberculosis are no more pronounced than are seen in moderate cases of chronic prostatitis and vesiculitis and diagnosis may be extremely difficult. If accompanied by an insidious epididymitis with softening and fistula formation, tuberculosis should be strongly suspected. The presence of recent or ancient lung tuberculosis is often of diagnostic value, and of course kidney or epididymis tuberculosis are very suggestive.

In calculus of the prostate it is sometimes possible to feel the isolated stones, but in other cases there is simply a general induration with little or no irregularity or nodules to lead one to suspect calculi. As a matter of fact these are often recognized only on X-ray examination, which should be made more frequently in cases of chronic prostatitis.

The diagnosis of prostatic hypertrophy is usually made from the enlarged globular lateral lobes with deep intervening sulcus, by the absence of nodules, induration and adhesions and particularly by the absence of pus in the prostatic secretion. In many cases, however, with inflammatory complications the hypertrophied prostate presents not only inflammatory induration and adhesions, but very purulent secretion, so that careful cystoscopic examination and studies of the prostatic orifice may be necessary for a differential diagnosis.

Cancer of the prostate in its early stages may closely simulate chronic prostatitis and is not infrequently mistaken for it. A localized indurated area of almost stony hardness should be considered suspicious, and most

careful studies made to exclude carcinoma. In some cases an exploratory perineal operation with excision of the affected area may be necessary to clear up the diagnosis. If physicians could realize the great importance of rectal examination, and the diagnostic importance of marked induration, many early cases of carcinoma of the prostate would be detected and radically cured by operation.

Treatment.—This should be directed towards the elimination of the infection, the softening of the inflammatory infiltration and adhesions and the correction of pathologic conditions of the posterior urethra, verumontanum, ejaculatory ducts and seminal vesicles. The most important of all is regular systematic massage or stripping of the seminal vesicles and prostate. The technic of this has been described at the beginning of this article. This should usually be carried out two or three times weekly, and sufficient pressure applied each time to empty more or less completely the seminal vesicles and the prostatic ducts into the urethra, from which the fluid escapes at the meatus and can be caught for microscopic examination. Following prostatic massage, irrigation of the urethra and instillation of some penetrating antiseptic is advisable. Our preference is 1 per cent mercurochrome which is absorbed deeply into the prostatic ducts, as shown by massage several days later when the red stained secretion can generally be obtained. Instillations of nitrate of silver (1 per cent or 2 per cent) into the posterior urethra have a markedly beneficial effect in chronic inflammatory conditions of the mucous membrane, verumontanum, vesical neck and trigone. In some cases urethroscopy should be employed and investigation of the utricular and ejaculatory ducts with dilating probes should be carried out and appropriate treatment instituted. If the verumontanum is enlarged and congested, granular or papillomatous, applications of nitrate of silver, either in the form of a small stick or preferably a 10 per cent or 20 per cent aqueous solution, are of great value, but this treatment should not be overdone, as we have seen many cases of marked impairment of sexual desire from overtreatment.

Sexual neuroses require very careful and varied treatment. Prostatic massage, irrigations and instillations are not infrequently followed by great improvement in the sexual powers, but often tonics and glandular extracts and aphrodisiacs are necessary to effect a cure and not infrequently very little can be accomplished. Such cases present very severe sexual psychoses and are, I believe, a prolific cause of certain forms of severe mental depression and even insanity. Dilatation of the urethra with large sounds or dilators is often of value and antiseptic irrigations are essential when chronic cystitis and urethritis are present. Referred pains are usually relieved by prostatic massage and local treatment as above outlined. Not infrequently chronic lumbago and other painful conditions in the back which have persisted for years clear up as if by magic, and likewise sciatic pains due to inflammatory infiltration around the seminal

vesicles or along the lateral walls of the pelvis disappear as a result of massage or hot rectal douches.

Contractures or bars at the prostatic orifice may often require operative treatment and Young's punch operation, by means of which inflammatory hypertrophy of the prostate may be removed, is usually entirely successful. The same operation is applicable to fibrous contractures of the vesical neck. Suprapubic excision of these structures may also be carried out and the Bottini operation or Chetwood's modification, and in some cases simple division of the sphincter vesicæ, as has been recommended by Geraghty, is effectual.

Prognosis.—The *prognosis* depends upon the extent of the lesion or the gravity of the symptoms. It is quite possible by massage and other treatment above indicated to eradicate completely the inflammatory induration of prostate and seminal vesicles. Grave changes in the sexual powers and painful conditions, local or remote, may often be cured. Occasionally the neurasthenia may be so pronounced as to baffle all attempts at cure.

TUBERCULOSIS OF THE PROSTATE

Frequency.—Tuberculosis of the prostate and seminal vesicles (which are usually found together) are probably much more common than usually supposed. No accurate statistics, either clinical or postmortem, are available. Isolated tuberculosis of the prostate is certainly extremely rare, but may occur, as shown by the early work of Guyon. The disease is almost always secondary to some focus either in the retroperitoneal or bronchial lymph glands or to some more pronounced lesion in the lungs, kidneys or elsewhere. Often, however, the primary focus is so small as to be undetectable, and the disease seems to be primarily in the prostate or seminal vesicles. The early involvement of the epididymis, often before any symptoms referable to the prostate or vesicles occur, frequently complicates the picture and leads to the diagnosis of isolated tuberculosis of the epididymis. Recent studies by MacFarlane Walker and others have shown that tuberculosis of the epididymis is generally secondary to the prostate or vesicles. The fact that the second epididymis becomes involved in the large majority of cases, even when the other side has been removed, is strongly presumptive evidence of the prostate and vesicles as a primary focus.

Pathology.—Tuberculosis of the prostate and seminal vesicles presents the usual gross and microscopic picture of tuberculosis in glandular organs. The lesion may be chronic and slight and remain for a number of years in a dormant or arrested condition. Small areas of suppuration or more or less extensive caseation are frequently found when very little is to be made out on rectal examination. In some cases the disease may be self-curative. Other cases follow a much more fulminating course, and

are accompanied by an extensive enlargement of the prostate and vesicles and invasion of the surrounding tissues, abscess formation, ulceration into the urethra and occasionally into the bladder and rarely into the rectum. With the onset of secondary infection, extensive perirectal, perineal or pelvic abscesses with extensive infiltration into surrounding structures may occur with multiple fistula formation with or without escape of urine. The urethra, bladder, epididymis, testicle, etc., may become involved in the tuberculous process. It may also extend upward into the region of the kidneys or reach the lungs by means of the lymphatics. A careful study among some 16,000 cases of pulmonary tuberculosis in various sanatoriums showed that, while tuberculosis of the seminal tract is a rare complication, it is an extremely fatal one, probably one of the most serious complications of tuberculosis of the lungs. This should lead to a much more careful study of the prostate and seminal vesicles in tuberculous patients.

Symptoms.—When the disease is confined to the prostate and seminal vesicles, the urethra, bladder and epididymis being still free from involvement, the symptoms may be so slight as to avoid detection for months or years. In the early stages the signs may be so slight as to make diagnosis impossible. When the disease becomes more advanced, pain, hematuria, frequency and difficulty of urination may occur, and in advanced cases the symptoms are so severe as to be very distressing. When complicated by urinary fistulæ and periprostatic or perirectal abscesses, the condition of the patient may be indeed deplorable.

Findings.—The urine may often be clear and free from cells and bacilli. Red blood corpuscles are occasionally present and not infrequently pus and tubercle bacilli may be found on careful examination of the sedimented urine or prostatic secretion. In doubtful cases inoculation of guinea pigs should be carried out with material obtained by prostatic massage. On rectal examination the process is usually characterized by greater irregularity, induration, nodulation and adhesions than in simple prostatitis and vesiculitis, but occasionally it is impossible to differentiate between them. Urethroscopy should usually not be carried out as traumatism may have a serious effect. Cystoscopy may often be necessary, first to determine whether lesions are present in the bladder and, secondly, for ureteral catheterism which should usually be carried out when tubercle bacilli have been found in the urine and prostatic secretion, in order to determine whether a tuberculous process is present in the kidney. Enlargement or nodules of the epididymis, especially if a discharging sinus is present, points strongly to tuberculosis of the prostate and vesicles. X-ray examinations of the chest and kidneys are of great importance and may reveal unsuspected lesions. The phenolsulphonephthalein renal function test may show an unsuspected unilateral kidney disease.

Treatment.—Rest, with proper sanatorial supervision in a dry sunshiny climate, with the body systematically exposed to the rays of the sun,

undoubtedly has a pronounced curative effect on tuberculosis of the seminal tract as well as elsewhere. Where such conditions are not available, it is questionable whether the usual sanatorial treatment of rest and forced feeding is of much value. In any event the case should be carefully watched and, if progressive, surgical intervention may be necessary. The majority of surgeons are of the opinion that, when the epididymis is involved, castration or epididymectomy is usually followed by a marked retrogression or arrest of the process in the seminal vesicles and prostate so that no additional operation is necessary. Statistics do not bear out this assertion and from 25 per cent to 40 per cent of all cases operated for epididymal tuberculosis eventually die of other tubercular lesions. Cunningham and others are of the opinion that injections of carbolic acid through the vas deferens are sufficient to obtain a cure in most cases of tuberculosis of the vesicles. Careful study of the literature, however, and of a long series of cases at the Johns Hopkins Hospital by Young, have shown that the ultimate results of such conservative methods are very poor, and that, when a definite tuberculosis of the prostate and vesicles is present with or without involvement of the epididymis, a radical excision of the seminal vesicles, ampullæ and lateral lobes of the prostate is the operation of choice; and, if the vas and epididymis are involved, these should be completely removed simultaneously by an operation through the groin. In fact the entire seminal tract on both sides, with the exception of a few millimeters of the ejaculatory ducts, can be radically excised without difficulty. Although the number of cases in which Young's radical excision of the seminal tract has been carried out is still limited, careful study of the first 15 cases, in 5 of which it was also necessary to remove one kidney, shows conclusively that remarkable results may be obtained in otherwise fatal cases. The results obtained already seem to indicate that the radical operation is unquestionably the method of choice.

HYPERTROPHY OF THE PROSTATE

This disease should really be called adenoma within the prostate. According to Sir Henry Thompson, 1 man in 5 over fifty years of age has prostatic hypertrophy, but only a small number of these cases are associated with sufficient obstruction to urination to cause much trouble.

Etiology.—The etiology of prostatic hypertrophy is uncertain. Statistics seem to show conclusively that it is not of inflammatory origin and chronic gonorrhea is certainly not a definite causative factor. Our studies seem to indicate that it is probably an accompaniment of long over-indulgence in coitus, as our statistics show that it is far more common in married men and, while there have been numerous cases among Protestant ministers, we have not seen a single case in a Roman Catholic priest.

Pathology.—The disease begins usually as a small adenomatous spheroid beneath the mucous membrane of the prostatic urethra. Other small spheroids form and as they grow they coalesce and become encapsulated by the surrounding tissues, the normal prostatic tissue being crowded outward by the development of the adenomatous masses which form the so-called hypertrophied lobes and may reach enormous size.

Histological Examination.—A histological examination shows that about 85 per cent are glandular in character, about 12 per cent fibromuscular and about 5 per cent inflammatory. The result of continued growth of the adenomatous, intraprostatic masses is to make pressure upon and distort the urethra. If there are two lateral enlargements the urethra is usually flattened into a vertical slit between them. If a median lobe is present the urethra is shoved upward and the lobe may grow out into the bladder so as to form an intravesical mass, behind which there is a pouch of varying depth. The urethra thus obstructed and distorted offers hindrance to urination.

It is necessary for the trigone to hypertrophy in order to carry on its function of opening the vesical sphincter as first pointed out by the writer and in some cases great enlargement of the trigone is found with a deep pouch behind it. In rare instances an anterior lobe develops in the anterior commissure of the prostate. The changes in the urethra, resulting from the varied types of prostatic enlargement, make catheterism difficult, and the rise of the middle lobe often offers serious obstruction to the introduction of a simple rubber or silver instrument. It is for such cases that the elbowed or coudé gum or rubber catheter is necessary to ride up over the obstructing middle lobe and enter freely into the bladder. Serious traumatism, and occasionally a tunneling of the obstructing median lobes is encountered from the rough use of improper instruments.

Cancer.—Cancer is present along with prostatic hypertrophy in an alarmingly great number of cases; probably at least 10 per cent of the cases of benign adenoma of the prostate being associated with cancer in another portion of the prostate, usually in the posterior commissure or lobe. Fortunately, in such cases the carcinomatous process is immediately beneath the posterior capsule where it can be felt on rectal examination and it is extremely rare to find an invasion of the hypertrophied lobes with carcinoma, except late in the disease, and only in extremely rare instances is there a development of carcinoma within the substance of the adenomatous mass. An interesting case of this sort has been reported from our clinic recently by Shaw.

It is not infrequent to see very extensive carcinoma of the prostate involving the posterior portion and invading the tissues in and around the seminal vesicles and base of the bladder, with no involvement of the adenomatous lobes in front of the urethra or bladder. Remote pathological effects of prostatic hypertrophy are vesical changes, particularly cellule and

diverticulum formation, distention with residual urine, hypertrophy and contracture of the bladder from overwork, dilatation of the renal pelves and the ureter, thinning of the renal cortex and destruction of secretory substance with the final formation of large hydronephrotic kidneys. With the advent of infection important pathological changes may result, such as acute urethritis, cystitis, ascending infection of the kidney, periprostatic and perivesical inflammatory infiltrations, general sepsis, etc.

Symptoms.—The development of small adenomata in the prostate occurs so insidiously that no symptoms may be produced for a long period. Hesitation and slight difficulty of urination are often the first symptoms noticed. Occasionally irritation, pain and frequency of urination are present, and sometimes slight terminal hematuria, due to straining at urination. In most cases the progress is slow and the patient may go for months or years with only a slight increase in frequency and difficulty of urination. In other cases, the obstruction rapidly increases and, with the development of residual urine, nocturia may become so pronounced as to disturb the patient's rest and eventually complete retention of urine may come on requiring immediate relief. In other cases, with gradually increasing obstruction and residual urine, back pressure effects upon the kidney lead to progressive impairment of kidney function and a chronic uremia which is associated often with hypertension and cardiovascular disease. Such cases usually complain of lack of appetite and feeling of slight nausea or acute vomiting, dizziness and loss of strength. In late cases the uremia may be very pronounced and the situation is grave, particularly if associated with severe infections.

Stone in the bladder occurs not infrequently and may greatly aggravate the symptoms, leading to strangury, hemorrhage, etc. The development of large diverticula, especially if infected, may seriously complicate the disease. In certain cases, the prostatic hypertrophy may reach great size with little or no symptoms. The only complaint of one of my patients was gradually increasing abdominal girth which necessitated the purchase of new trousers frequently. There was no urinary disturbance or discomfort of any sort present, although he had 2,000 c.c. of residual urine and the bladder was so greatly distended that it reached above the umbilicus. In this case the kidneys were so greatly impaired that the patient died of uremia.

Examination.—The great frequency of prostatic disease should lead to periodic examination, at least every year, of men past fifty years of age. This should include not only urinalysis with a phthalein test, but also prostatic examination through the rectum. In most cases of simple adenoma of the prostate enlarged lobes or lobules can usually be palpated by rectum. If the prostate is found to be larger than normal and pressure in the median line shows a depression between two elastic lateral enlargements, the diagnosis is prostatic hypertrophy. It is sometimes possible to

feel through the rectum the enlargement of the middle lobe, but not infrequently this cannot be done. The prostatic secretion may be examined microscopically and prostatitis thus ruled out, but pus cells may be present in hypertrophy. The finding of an extremely indurated nodule or elevation of the prostate should usually lead one to suspect carcinoma. If a very definite hypertrophy is made out, the symptoms are slight, and the phthalein test is almost normal, no further examination may be necessary or advisable. If, however, the patient complains greatly of frequency of urination, particularly nocturia, and has marked discomfort, especially if the phthalein test shows impairment in renal function, catheterism to determine the residual urine and bladder capacity and to obtain an accurate renal function test is advisable. Cystoscopy should then be carried out to map out the enlargements and see whether vesical trabeculation and cellules or stones are present. With the cystoscope in the urethra, the rectal examination may be of great aid in determining the thickness of the suburethral median portion of the prostate and to evaluate an induration which may be suspicious of carcinoma.

If a large amount of residual urine is present, immediate evacuation may be dangerous and in such cases the urine should be replaced by a simple solution, such as 1 to 1,000 meroxyl or 4 per cent boric acid, and gradual up-hill drainage of the bladder should be instituted. If this is not done, immediate suppression of urine may result with fatal uremia. I have not infrequently had patients walk into the clinic apparently feeling well, yet they died within three days of fatal uremia after simple catheterism. Autopsy in these cases shows an almost complete destruction of the kidneys from back pressure. By proper gradual evacuation of the bladder with inlying catheter, and intake of water in large amounts by mouth, infusion, rectum, etc., such cases can usually be carried to successful operation, with eventually almost complete restoration of renal function.

Diagnosis.—This has already been discussed in speaking of the examination. Chronic prostatitis, tuberculosis, carcinoma, prostatic calculi, chronic fibrous prostatitis with contracture of the vesical neck or median bar have all to be considered and differentiated by very careful urological studies.

Treatment.—The great frequency of prostatic hypertrophy would lead one to suggest methods of prevention, but unfortunately the only advice which could be offered would be to abstain from overindulgence in coitus, advice which probably would not be followed. When the disease is in its incipiency, the patient should be warned against becoming chilled or going too long without voiding urine. Prostatic massage apparently does reduce the size of early adenomata and ward off disagreeable symptoms for a time and, if irritation or pain are present, small instillations into the deep urethra of a 1 per cent nitrate of silver and hot rectal douches may be of

value. As a rule, however, it is best to leave these patients alone, simply warning them of the condition and advising them to return for further examination should urination become progressively more frequent or difficult. Catheterism should usually not be attempted unless a proper catheter is at hand, preferably a coudé catheter of soft rubber or gum, and of course the strictest precautions against infection should be taken by cleaning the genitalia, and irrigating the urethra with an antiseptic before passing a carefully boiled catheter, with sterile hands, into the bladder.

The first catheterism is not infrequently followed by complete retention of urine and the necessity for adopting a catheter life. It is therefore essential that when a physician proposes catheterism to a patient, the latter should be in a position to return for subsequent catheterism as often as may be necessary and the physician should be prepared to give the patient proper care in the presence of the complete retention of urine and infection which may ensue. It is very essential that the residual urine, bladder capacity, vesical tonicity and renal function be obtained at the first catheterism, and that the blood urea be obtained if the renal function is poor—say below 40 per cent phthalein in two hours. In such cases surgical treatment should be at once considered and consultation obtained if necessary.

Modern advancement in the surgery of the prostate has shown the great importance of preliminary treatment, which consists of proper drainage of the distended bladder with relief of the renal back pressure, and the use of large amounts of water by mouth and, if necessary, by rectum, or by subcutaneous infusion, to accelerate the kidney output and to ward off uremia and infections. During the progress of the treatment biweekly phthalein tests and, if these show a very poor function, blood ureas should be carried out, and operation not attempted until the condition of the patient warrants it and the renal function has been stabilized, and if possible, increased up to 40 per cent in two hours.

In some cases (1 per cent) it is necessary to supply suprapubic drainage instead of an inlying urethral catheter, but it is almost always possible to bring even desperately sick patients into a condition sufficiently good for prostatectomy, which may be carried out either through the perineum —a method which I prefer and think distinctly less dangerous—or transvesically.

The internist is frequently called in to aid the surgeon in the determination whether or not an operation can be safely performed and in the postoperative treatment. During recent years there has been a complete reversion of opinion as regards the operability of apparently desperate cases. Patients who were considered too dangerously sick for operation ten or fifteen years ago are now brought to satisfactory condition by proper preliminary treatment. Mention has already been made of the severe renal complications which can be completely eradicated by

catheter drainage and water in large amounts. Diabetes mellitus is also amenable to proper treatment, even without the use of insulin, so that now almost all such cases can undergo prostatectomy.

Cardiovascular disease is very common in prostatic hypertrophy. The well-recognized cardio-renal relation would lead us to expect it, since 43 per cent of the cases have renal impairment with a phthalein below 50 per cent. Arteriosclerosis is so very common as to be almost negligible except in very severe cases. Even with a history of cerebral attacks or "apoplectic strokes," it is usually possible to carry out perineal prostatectomy under ether anæsthesia successfully. In my series of 1,000 cases there were 12 in which one or more "strokes" with "paralysis" had occurred before admission, and among these there were no deaths. High blood-pressure is frequently encountered. In my last series of 198 consecutive perineal prostatectomies without a death there were 24 with blood-pressure between 160 and 179, 10 between 180 and 189, 6 between 190 and 199, 2 between 200 and 209, and 3 over 210. Twenty-seven per cent, therefore, had a blood-pressure of over 160. During operation on 1 of these cases, the blood-pressure reached 285, but the patient went through operation and convalescence successfully. Heart disease was present in 48 per cent of the cases, generally not grave but sometimes quite serious, and yet under ether anæsthesia they did well. In 1,049 prostatectomies there was only 1 operative cardiac death. Such cases should have ether anæsthesia and not nitrous oxid.

Respiratory infections are of extreme importance to the surgeon and in the presence of even slight acute inflammation of the nose, throat, trachea, bronchi or lungs I always delay operation and give the infection a chance to clear up. Ether is far more dangerous in these cases, and the use of gas-oxygen has certainly cut down the number of postoperative pneumonias. Pulmonary embolism was responsible for 1 death during preparatory treatment and 6 after operation. It is one of the most important complications during the convalescence.

Old age has little or no effect upon the mortality apparently up to seventy-five years. In 213 cases between seventy and seventy-five years of age my mortality rate after perineal prostatectomy was only 2.8 per cent; but in 28 cases between eighty and eighty-four years of age the mortality was 7 per cent.

Rest in bed, light diet and water in large amounts, and vesical drainage generally bring the kidneys, heart, lungs and gastro-intestinal tract into good condition for operation. After operation the medical consultant may be again confronted with shock, which is to be combated by submammillary infusions or intravenous blood transfusions, as well as proper cardiac stimulants, and abdominal distention, which may be treated prophylactically by the early use of oil or saline purgatives, or later by giving pituitrin frequently. Enemata should be avoided in prostatic surgery on

account of the danger of embolism. I have lost 2 cases following ordinary enemata.

Pulmonary complications are best avoided by avoiding hypostatic congestion, by changes of position and by getting the patient up and about as soon as possible. I generally find it possible after perineal prostatectomy to have the patient in a wheel chair on the fourth or fifth day and and walking early in the second week. Cerebral thrombosis occurs infrequently and is probably due to arteriosclerosis. In 2 of my cases I am of the opinion that the use of drugs which had a depressing effect upon the circulation was responsible (aspirin gr. 12 in 1 case, and eserin in the second).

Infection is a most important factor, both during the preoperative and postoperative treatment, and should be combated vigorously by appropriate, mild antiseptics. Great progress has been made in recent years and the use of acriflavine, mercurochrome, meroxyl, Dakin's solution, etc., have greatly reduced the infections and simplified the complications. Hexamethylenamin is undoubtedly of some value if given in large doses— 15 gr. four or five times a day after meals. Its effect can frequently be increased by the use of sodium benzoate or acid sodium phosphate— 10 gr. before meals. But the necessity for imbibing large quantities of water in order to improve the renal function militates against internal antiseptics and, between the two, water is probably the most important.

Operation.—What can the practitioner expect from operation? A mortality of less than 4 per cent from perineal prostatectomy and in expert hands practically nil; a mortality somewhat higher after suprapubic prostatectomy. In general hospitals the mortality of the occasional operator is unfortunately still quite high—recent studies have placed it between 10 and 20 per cent and Keyes estimates it even considerably higher than that. Practically normal urinary function is obtained in almost all cases. There may be slightly increased frequency owing to chronic contracture and thickening of the bladder or from cystitis. In rare instances, strictures occur after both perineal and suprapubic operations, requiring dilatation. In very rare instances, incontinence occurs, but almost always due to operative fault. Injury to the trigone in suprapubic operations and the rectum in perineal operations occasionally occurs, but again is avoidable. Impairment of sexual powers results in probably 40 per cent of the cases, but in the great majority of cases the patient is restored to normal urinary and sexual life, even when the condition has been desperate and the urinary organs greatly impaired by long-standing residual urine, back pressure and infection. Careful studies of a long series of cases show that the catheter life, if followed over a great length of time, is much more dangerous and associated with a mortality three or four times as high as that of prostatectomy. Cases should therefore be brought to operation fairly early, before the onset of a catheter life and

before chronic retention and infection have markedly impaired the general health. The splendid results obtained by prostatectomy, even in very aged individuals, is one of the most gratifying developments in the surgery of the past twenty years.

CANCER OF THE PROSTATE

About 20 per cent of patients who present themselves complaining of prostatic obstruction are found to have cancer. This is the experience of various large clinics. In about one-half of the cases prostatic hypertrophy is present at the same time and the obstruction present may be due to the adenomatous lobes and not to the cancer. In most instances the posterior, subcapsular portion of the prostate—the so-called posterior lobe—is the site of primary development of cancer. From there the disease spreads in all directions, but usually stays within the fibrous capsule of the prostate, traveling upward until the region of the seminal vesicles is reached, when it spreads out into the areolar tissue back of the trigone surrounding the vesicles and ampullæ, and from there goes upward along the lateral walls of the pelvis, where glands are first encountered. The mucous membrane of the urethra and bladder are rarely invaded, except late, and the rectum is also protected from invasion by the two layers of Dénonvillier's fascia which separate the prostate and rectum.

Cancer may remain for months and even years entirely prostatic or retrovesical and prerectal, without invasion of the urinary or rectal cavities. As remarked before, adenomatous lobules, encapsulated as they are, remain free from invasion by the coexistent cancer until late, and it is extremely rare to find cancer arising de novo within hypertrophied lobes. The most important metastasis of carcinoma is to the bones of the pelvis and spinal column, and X-ray plates show that about 30 per cent of the cases are already metastatic when applying for treatment. Later general metastasis may occur.

Symptoms.—The symptoms of prostatic cancer are often almost indistinguishable from those of hypertrophy. The patient usually suffers more pain and is especially prone to pain in the back, hip and thighs. Hematuria is apparently no more common than in hypertrophy, and is not usually a prominent factor. Obstruction may be absent until late, but there is generally an increasing obstruction with residual urine which may eventually lead to great vesical distention and complete retention of urine with the same complications, due to back pressure and distention, as described under Prostatic Hypertrophy. Swelling of the legs, due to obstruction of the lymphatics or veins, is not an uncommon symptom, and I have seen cases in which this was present to a marked degree without any urinary symptoms and without pain.

Examination.—All men past fifty years of age with urinary symptoms, or with pain below the diaphragm or swelling of the legs, should be considered possible cancer-of-the-prostate cases, and the general practitioner cannot be too strongly urged to make a rectal examination part of his general physical examination, and to advise middle-aged and old men to have periodic surveys in which the urine, rectum and prostate are included. I have recently seen a fairly early carcinoma of the prostate which was discovered in this way and cured by a radical operation. There were absolutely no symptoms of any sort in this case. The discovery of a marked area of induration in the prostate or seminal vesicles, the rest of the prostate being soft, should be viewed with suspicion and cystoscopy and other examinations carried out to exclude cancer.

If necessary, early exploratory operation in which a section is removed for microscopic study should be advocated. Later when the disease involves the entire prostate the diagnosis is easily made by the extreme induration and nodular irregularities which come on ultimately. As the disease progresses upward it forms an area of induration on one or both sides of a broad plateau which extends from one side of the pelvis to the other. Invasion of the urethra and bladder does not occur usually until very late. The cystoscope is of value in showing the absence of the usual lobules of hypertrophy and the presence of a subtrigonal, suburethral indurated mass which generally means carcinoma.

Treatment.—Unfortunately most patients arrive too late for a radical cure, but if practitioners could be persuaded to advise regular health surveys and to examine the prostate per rectum, many cases amenable to a radical cure would be detected. The operation devised by the writer in 1905 has now been carried out in 20 cases with apparently 73 per cent of permanent cures followed over three years.

The operation consists of a complete excision of the prostate with its capsule, urethra, neck of the bladder, most of the trigone, both seminal vesicles and the ampullæ of the vasa deferentia. The defect is repaired by anastomosing the wide open bladder with the membranous urethra. This is not a difficult procedure and by the most recent technic a continent bladder and normal urination is obtained and stricture of the urethra does not occur at the site of anastomosis. All cases in which the cancer is apparently confined within the prostate or has projected only a short distance into the region of the seminal vesicles, the bladder being free from invasion, are proper cases for this radical procedure. Unfortunately most cases come too late and some form of radium treatment should usually be adopted.

If there is little or no urinary obstruction, application of radium through the rectum, urethra or bladder, as advocated by Young, will often give wonderful benefit. Both the obstruction and the hemorrhage may be relieved and in rare cases a radical cure is apparently obtained, as

shown by a careful study of 100 cases from our clinic by C. L. Deming. Radium may also be introduced into the prostate by means of needles plunged through the perineum with the assistance of a finger in the rectum; or by emanation points inserted through the urethral wall by means of cystoscopy or urethroscopy, as advocated by Barringer. Radium may be introduced directly into the prostate and seminal vesicles through an open perineal wound or by a suprapubic incision. Both of these methods have been employed successfully in a limited number of cases. In implanting radium it is important to use needles of small dosage and of sufficient quantity so that they can be placed 1 mm. apart and remain in situ several days. I personally prefer platinum needles containing only 1 mg. each and use twenty or thirty so as to completely stud the area with points 1 cm. apart, both superficially and deeply and, in my opinion, these can be best introduced through the perineum without opening the urinary tract. Emanation points, also preferably of small dosage (½ to 1 mg.), may be inserted and remain permanently.

When obstruction to urination is pronounced there is usually prostatic hypertrophy present and Young pointed out, in 1905, that it was possible to obtain splendid functional result by enucleating the prostate by removal of the hypertrophied lobes but not attempting to excise the too extensively involved posterior lobe. Many of these cases have remained free from obstruction and lived in comparative comfort for several years. This operation can now be combined with the implantation of radium into the carcinomatous areas and adjacent structures, and in many instances has given most satisfactory results.

Carcinoma of the prostate, even though advanced, is therefore still amenable to treatment either by radium or operation and great relief can usually be obtained although life may not be greatly prolonged. A few brilliant results seem to promise even greater success with radium in these cases in the future. In early cases a cure may be obtained by the radical operation.

SARCOMA OF THE PROSTATE

Sarcoma of the prostate is a very rare disease. Probably not more than 50 cases have been reported in the world's literature, and we have seen only 5 in 4,000 cases of prostatic obstruction of various types. The sarcoma develops not in the gland tissue of the prostate but generally in the fibromuscular tissue adjacent. In some cases the prostate itself appears fairly normal and surrounded by the sarcomatous mass which frequently almost fills the pelvis and may be palpated suprapubically. The bladder is usually not invaded but is greatly compressed by the retrovesical mass and urination may be very frequent or difficult, and the rectum is often so greatly compressed as to interfere with defecation.

Symptoms.—The symptoms are varied, a feeling of pressure or fullness, pain, and urinary or rectal distress, with loss of weight and strength. Occasionally the pelvic discomfort is accompanied by pains in the hips and thighs, and occasionally by swelling of the legs.

Examination.—Rectal examination generally reveals a large, elastic, round mass which crowds the rectum backward and extends upward, usually as far as the finger can reach, obscuring the seminal vesicles and bladder and often crowding down upon or invading the prostate. The mass is often palpable suprapubically. Catheterism may be extremely difficult and the bladder is usually small, but without residual urine. The mass is usually so much larger and softer than carcinoma and it occurs in patients so much more youthful that diagnosis is generally not difficult. Rarely it may be indurated.

Treatment.—There is no record, I believe, of a radical cure of sarcoma of the prostate by operation, but in 2 of our cases marvelous results have been obtained by radium and also by X-ray. Complete disappearance of the huge mass has been effected in 2 cases.

STONE IN THE PROSTATE

This is a condition which not infrequently accompanies prostatic hypertrophy. Small seed calculi are found not infrequently between the encapsulated adenomata and the surrounding prostatic capsule. In some cases the calculi are larger and may be seen within the substance of the hypertrophied lobes. They may ulcerate into the urethra and from there escape externally or into the bladder. Calculi are also found in younger individuals in whom there is no hypertrophy present. In such cases they may be scattered throughout the substance of the prostate and vary in size from a millet seed to 1 cm. in diameter. In most cases they cause no discomfort and are, in fact, symptomless; in other cases irritation or pain is produced and, where ulceration into the urethra has occurred, there may be suppuration.

Prostatic calculi may be found on rectal examination, being recognized as hard nodules in the prostatic substance. In other cases it is absolutely impossible to feel them and they are not infrequently discovered accidentally by means of the X-ray or on passing a sound or cystoscope. Often, however, they are found at operation for prostatic hypertrophy. In rare instances, the prostatic calculus assumes large size and may completely fill the urethra and often project into the bladder. Such cases are really urethral calculi and not prostatic in origin.

Treatment.—Small, symptomless prostatic calculi usually require no treatment. When pain or infection are present, perineal operation, with partial enucleation or excision of affected portions of the prostate and complete removal of the calculi, is indicated. When present with hyper-

trophy they can be most easily removed through the perineum and rarely cause any complications.

CYSTS OF THE PROSTATE

Cysts of the prostate may be of various types. One sees, not infrequently, small cystic areas of the mucous membrane of the posterior urethra or verumontanum. Occasionally the utricle contains a cyst which may attain considerable size. Prostatic cysts which project into the urethra and from there through the internal sphincter into the bladder are occasionally seen. They may lead to partial or complete obstruction to urination. In such cases operative attack—either by fulguration through a catheterizing cystoscope, as has been carried out by the writer in one case; or extirpation with the cystoscopic rongeur; or by suprapubic incision—may be indicated. Operative results are excellent.

VALVES OF THE PROSTATE

Obstruction to urination due to valves in the prostatic urethra is not a rare condition in children, but the subject has received very scant notice in the American literature. Owing to the deep-seated nature of the condition most cases have not been recognized. In an extensive study of our cases and the literature, 40 cases were collected, 12 of which we had personally examined, 8 being subjected to operation. Englisch was one of the first to point out the occurrence of fatal obstructions due to valves in the prostatic urethra in children, and since then various autopsy reports of similar conditions have been made; but nowhere in the literature did we find any serious attempt to subject these cases to operative cure. Undoubtedly many of the cases of obscure hydronephrosis and hydro-ureter in children are unrecognized cases of this type, and probably fairly common.

The disease consists of one or more valves or diaphragms of thin mucous membrane of the prostatic urethra, generally attached along the crista galli or verumontanum, and spreading from there to the lateral or superior walls of the urethra. These valves cause obstruction to urination and a dilatation of the bladder and vesical neck, and of the ureters and kidney pelves. Ultimately destruction of the renal cortex from back pressure comes on.

Not infrequently in these emaciated children one can see the greatly distended tortuous ureters through the abdominal wall, and the kidneys may be large, soft, hydronephrotic sacs. Incontinence of urine or great frequency and difficulty of urination are usually present. The urine is generally of low specific gravity, the renal function very poor and blood urea high. On attempting to pass a catheter one usually meets with an ob-

struction in the deep urethra, and often it is impossible to enter the bladder, owing to a pouch beneath the diaphragm. Sometimes a small catheter may strike the narrow opening between the valves and pass into the bladder. In one of our cases it was necessary to use a ureteral catheter for this purpose and a large amount of residual urine, of low specific gravity, was withdrawn.

Diagnosis.—One should be suspicious of prostatic valves when incontinence of urine, vesical distention, chronic uremia, visibly or palpably enlarged kidneys or ureters are present, and the renal function, as shown by the phthalein or blood urea tests, indicates marked renal impairment. Obstruction to a catheter in the prostatic urethra confirms the diagnosis.

Treatment.—As a rule, these patients are in such a serious condition that the most gentle treatment possible is indicated. It is not wise to evacuate the bladder completely at once, but slow drainage through a small catheter and the use of large amounts of water to prevent suppression of urine should be employed and may eventually bring the patient to such improvement that operation can be carried out. In some cases the passage of a sound through the diaphragm, thus dilating or rupturing it, leads to a cure. Not infrequently, however, a pouch or false passage beneath the diaphragm makes it impossible to introduce a sound into the bladder. An operation through the perineum (direct attack upon the prostatic urethra with excision of the diaphragm or valves) or suprapubic operation with division of the membrane through the dilated internal sphincter upon a sound which has been passed through the anterior urethra may be carried out. I have employed all of these methods with success. In 1 case I was able to use a punch of very small caliber and thus excised radically the obstructing valve through the urethra without open operation and with complete cure. The details of 8 cases in which I was able to save the life of the patient by operation are recorded in the paper above referred to. In the literature we have been unable to find but one case which was cured, and this by the accidental passage of a sound; the other 25 cases were autopsy reports. The importance of this much-neglected condition in children cannot be overemphasized.

HYPERTROPHIED VERUMONTANUM

That fatal obstruction to urination may occur as a result of hypertrophy of the verumontanum has recently been shown in an interesting report by Bugbee, who reports 2 cases. The complications and symptoms are evidently much the same as are produced by valves of the prostatic urethra and careful examination should lead to a detection of this condition and operative cure, which so far has apparently never been carried out. The whole subject of obstructive urinary conditions in children is a field of great interest, which has received very little attention.

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CHAPTER V

TREATMENT OF STERILITY

I. C. Rubin

STERILITY IN THE FEMALE

The treatment of sterility in the female must depend upon the etiology in each case. While this is not always clear and in many cases remains an insolvable question, for practical purposes the causes of female sterility group themselves broadly into four classes:

1. Congenital anomalies of the internal and external genitalia and acquired deformites of the external genitalia which make the sex act impossible or difficult. Failure in development of the primary sex glands as well as the rest of the genital apparatus render the individual incapable of conceiving (impotentia coeundi et generandi).
2. In the absence of these factors, unfavorable vaginal and cervical secretions.
3. Stricture or occlusion of the fallopian tubes.
4. Ovarian deficiency, that is, faulty ovulation. This group includes constitutional anomalies and diseases which in all probability operate against fertility by their destructive or inhibitory influence upon the ovaries.

Treatment.—The gynaplasias are hopeless. Rudimentary uterus and ovaries with concomitant arrest in constitutional development are not amenable to cure. Such individuals may rarely "catch up" late in life even toward the approach of the menopause and then conceive for the first time. Atresia and septate formation of the hymen are the most favorable, particularly when surgical perforation or removal is accomplished before the tubes are the seat of hematosalpinx. So-called infantile and subnormally developed uterus can be stimulated by electricity (galvanism), by the insertion of a stem pessary and by general nutritional increase and active exercise. Horseback-riding is particularly recommended. The sex act itself stimulates development after a certain length of time has elapsed, such time interval varying with the individual. Dyspareunia is

curable in most cases. Inasmuch as the cause underlying this difficulty is fear, reassurance is important and proper instructions to both male and female within their combined presence is often efficacious. In cases with bad levator spasm, sensitive rigid hymen, etc., I have been obliged to do a thorough dilatation of the introitus, cut the superficial portion of the muscles and sew the vaginal mucosa in such fashion as to convert the vertical incision into a transverse which results in widening the vaginal orifice.

An important cause of infertility is to be found in pathologic vaginal secretion. To Reynolds belongs the credit for emphasizing this fact. Huhner has recommended examining the secretions in the vagina and cervical canal as well as the uterine cavity for the presence and activity of spermatozoa. Where these are present and motile in the cervical canal, the husband may at once be exonerated from impotence. It must not, however, be taken for granted that finding living spermatozoa in the female genital tract means that such semen is necessarily fertile for that woman. There must be other as yet not determined factors besides motility in the semen that make for fertility, because not every discharge of semen is capable of causing impregnation, etc. Vaginitis of any kind must be cleared up. The vaginal flora in some cases are undoubtedly inimical to the spermatozoa. It is well in obscure cases to treat the vagina by suppositories or douches of lactic acid bacilli in order to destroy the more pathogenic microörganisms. The acute form of vaginitis may be treated by complete rest, abstinence from coitus, and topical applications of antiseptic and astringent douches and tampons. Erosions of the cervix are not always inimical to spermatozoa but, inasmuch as they cause a discharge of tenaceous mucopus which occludes the external os, they should be treated and cured. This can be accomplished by linear cauterization with the actual cautery (Dickinson), by caustics such as silver nitrate or copper sulphate and, if need be, by plastic operation. The plug of mucopus from the endocervix is a potent factor in the causation of sterility. It must, therefore, be removed by alkalis, by germicidal applications to the cervical canal, chiefly iodin, silver, mercurochrome or acriflavine. The cervical mucous plug may also effectively be removed by suction, as recommended by Young, by fitting a celluloid capsule over the cervix, as recommended by Pust, or by electric ionization, as practiced by Burns. In the event of failure with these measures, a thorough dilatation and curettage of the cervix mucosa may be tried. The same can be accomplished by Paquelin cauterization or the infected area may be surgically removed by the Sturmdorf technic or by cervical amputation. The drawback of these operations, however, even when done by competent hands, is in the lessened chances of pregnancy that appear to attend the postoperative course.

Acute flexions render the patient prone to vaginal discharge; they

must therefore be corrected by posture, by pessaries or eventually by operations. Chronic passive congestion is still another cause of faulty secretions. That due to constipation is chiefly to be considered. General systemic conditions, such as cardiac decompensation, are occasionally the cause and, while these patients should not bear children, they may be willing to take the chance of pregnancy and therefore may seek help in this respect. Attention to the bowels, proper exercise, astringent douches, sitz baths and cardiac stimulation may appropriately be used to reduce pelvic congestion. In cases of weak males, artificial impregnation may be resorted to also where the cervix secretion appears to be lethal to the spermatozoa in spite of all attempts to cure it. Personally I have had no success with this measure. R. L. Dickinson has reported some successes, however, and in special cases it certainly merits trial. It should be preceded by testing the patency of the tubes and the greatest aseptic precautions should be maintained, as the injection of fluid into the uterine cavity in careless hands and even in those of experts may be followed by adnexitis, pelvic exudates, etc.

When the tubes are closed, conception cannot take place. Unless the mechanical obstruction is relieved, sterility remains absolute. A strictured tube may permit of a tubal pregnancy taking place. This tubal factor may now be diagnosed by the transuterine insufflation with carbon dioxid gas. When the tubes are found to be passable for the gas under a pressure not exceeding 100 mm. of Hg, they may be regarded as normally patent. When the mercury is at 200 mm. Hg or upwards there is occlusion; when the pressure rises to 140 to 180 mm. Hg, and is followed by a subphrenic pneumoperitoneum, pregnancy may be possible. A number of pregnancies have been observed to follow this diagnostic procedure in the hands of others besides myself. The time is now proper for reports of these pregnancies. I should consider the insufflation of therapeutic value in a case of at least five-year sterility, where the tubes were found relatively stenosed as indicated by the increased pressure required to force the gas through the tubes. Further, pregnancy should intervene shortly after the insufflation, at least within a few months following it.

A few instances of pregnancy in my series of sterility cases have followed the insufflation and were in all probability due to it, as the next awaited period was skipped. A number of others have become pregnant after the transuterine insufflation, but the matter of coincidence could not, properly speaking, be dismissed. Where the test points to severe stenosis, resort can be had to repeated insufflations in the hope that soft adhesions may be overcome, that a plug of mucus may be dislodged or that congenitally spiral tubes may be straightened out. The cases that have become pregnant may owe their success to some such factor as those just mentioned. In the hands of experienced gynecologists the pressure may be

made, on the third or fourth test, to reach 250 and in favorable cases 300 mm. Hg. *Care must be taken, however, to introduce the gas at a pressure rate flow not to exceed twenty seconds in order to raise the mercury column to 100 mm. Hg.* With this precaution no serious ill effect can be produced. This is not, however, to be recommended for less experienced workers. Plastic operations upon the tubes have not been generally successful, the percentage of relief not exceeding 2 to 5, that is, 1 in 50 or at best 1 in 20. Whatever type of tubal plastic operation may be undertaken, postoperative insufflation should be systematically done to keep the opening artificially made permanently patent. In this procedure lies perhaps better encouragement than has hitherto attended the operation of salpingostomy.

In this connection it may be stated that two types of tubal closure offer the best prospects of surgical success. One is agglutination of the fimbria without hydrosalpinx formation, where the canal can be restored by simply squeezing the tube open (the adhesions having been caused by extragenital inflammation, appendicitis, etc.) The other is a hydrosalpinx which permits of a wide opening to be made at the ampullated clubbed end. The inflammation being healed out, patency may persist after the operation. It goes without saying that in such cases the ciliary action of the tubal epithelium is at least partly retained.

The ovarian causes are the least amenable of all. Whether or not there is palpable pathology, such as cystic or enlarged, tender adherent ovaries, the character of the menses may be depended upon to indicate the degree of ovarian function. Normal menses may safely signify healthy functioning ovaries. Abnormal menses, the menometrorrhagias, or oligomenorrhea, denote either excessive function or subnormal function. These individuals frequently owe their sterility to the perverted ovarian activity. In such cases partial resection of the cystic-bearing area or removal of the cyst contents by puncture, as practiced by Reynolds, may be worth considering. For the underfunctioning ovaries the internal administration of thyroid extract is helpful because it appears to stimulate ovarian activity. Pituitary extract is given by some and believed to exercise a similar influence, but, if favorable results are obtained by its use, and this applies to other endocrine products, their modus operandi is certainly not clear. An additional supply to the organism of ovarian residue and whole ovary is also useful. Inasmuch as the ovaries are linked up with calcium metabolism, the administration of calcium lactate or calcium carbonate has, it has seemed to me, been helpful in some cases.

Whether the irritative effect of X-ray upon the ovaries as first clinically applied by Thaler in cases of amenorrhea may result, not only in reëstablishing the menses, but in the regular monthly shedding of reproductive ova, is a matter for the future to determine. At present this pro-

cedure offers some prospect of hope and merits clinical trial.[1] In certain cases of habitual abortion not due to lues, corpus luteum extract given over a long period of time has been successful in allowing the young ovum to maintain its nutritional foothold in the uterus. Antisyphilitic treatment in appropriate cases has saved many embryos from untimely death. A well-mixed liberal diet appears to be essential for good ovarian function. General wasting diseases appear to have an elective destructive effect upon the ovaries.

Where no gross defect is present, where the factors are slight in their clinical importance, where even the semen appears to be deposited properly in the cervical canal, but is perhaps moderately deficient in the quantitative content of spermatozoa or their qualitative property, namely, motility, the most important cause of sterility is excessive coitus. A period of enforced continence for two or three months may be followed by conception. The most favorable time for successful coitus is within a week after the cessation of the menses. There should not be more than two or three acts of intercourse that particular month and none within a week of the next expected period. Should this period be skipped it is mandatory to abstain from further coitus for at least two and a half or more months.

Patients coming for relief of sterility must in the absence of any gross pathology be instructed not to use antiseptic douches; these are frequently employed in ignorance. They must learn to control urination, avoiding emptying the bladder for several hours after coitus. They will do well to void beforehand. Postural helps are in some cases important. Whether or not sexual anesthesia plays a rôle has not been clear, as some women who have borne four or more children aver that they never experienced libido or orgasm. Nevertheless, in certain cases this appears to be a factor. In general, however, the psychic element in female sterility occupies a very minor and perhaps altogether negligible place as compared to its rôle in male impotence and male sterility.

There still remains that small group of sterility cases in which both partners appear to be perfectly healthy by all the evidence available and yet the woman remains sterile. As has been demonstrated by some re-marriages each may prove to possess fertility. What the underlying cause may be, biological, biochemical or serological, remains to be determined. The infertility of hybrids in lower animals is suggestive but throws no light on the problem in the human species. Future research will have to engage itself in the solution of this and kindred problems in sterility and perhaps more intensive work in human clinical material will clear up obscure points.

[1] Since preparing this paper, the writer has had one successful result following stimulating X-ray treatment in a case of amenorrhea of over a year's duration. Pregnancy ensued upon the first return of the menses.

STERILITY IN THE MALE[2]

Sterility in the male usually means sexual impotence. The impotence may be both mechanical (impotentia coeundi) and generative (impotentia generandi). The first as a rule involves also the second, but potency may be retained although the associated faculty of impregnation is lacking.

There are three groups of male sterility:

1. The secretion is normal but there is some defect present, owing to an anomaly of the genitals, in the mechanism of ejaculation or insemination.
2. Coitus is perfect but there is no ejaculation of normal semen (aspermatism).
3. The ejaculated fluid is incapable of fertilization, that is, azoöspermia or necrospermia.

Among mechanical impediments, hypospadias and epispadias, as well as urethral fistulæ which interfere with proper insemination, yield only to operative therapy. When the defect is very far back it causes sterility, but in the average case the anterior and posterior vaginal walls close over the defect, thus avoiding sterility. Deviations of the penis, acquired or congenital, and shortening of the frenulum interfere with the proper ejaculation into the vagina. This is perhaps the most favorable lesion as it is readily amenable to surgical cure.

Aspermatism.—Except when this is due to stricture of the urethra, to tumors or to phimosis, therapy is very unsatisfactory. Circumcision in the case of phimosis, dilatation in case of urethral strictures and the endoscopic removal of obstructing tumors result in cures. Cases of prostatism with urethral spasm and retention of the semen can also be favorably influenced by graduated metallic sounding and mild astringent instillations.

In some cases, however, the aspermatism is due to a defect in the excitability of the ejaculation center in the lumbar plexus (atonic aspermatism). The congenital variety is incurable. Acquired atonic aspermatism is due, in the majority of cases, to excessive demands made upon the center. Therefore, the best procedure in its restoration is rest. Abstinence may be followed by return of function. A stimulating diet and general regimen will also help. Neurasthenics will require sedatives and psychic treatment with astringent instillations, and introduction of metallic sounds will help to reduce the increased irritability. In instances of anesthetic

[2] The material on treatment of male sterility has been taken from Casper's "Text Book of Urology" as it has seemed to me to give the most concise and yet complete outline of treatment of this malady in the male.

aspermatism the use of faradism has resulted in the return of sensation. Occasionally the inhibition resides in the brain. Such inhibition may arise from profound psychic impressions, such as that of infidelity, etc., which are powerful enough to make the cerebral center repress the ejaculation center. Such cases are not always amenable to medical treatment. Yet through suggestion and psychoanalysis some good can be accomplished.

The treatment of azoöspermia is most unsatisfactory and is limited because either the testes are congenitally lacking or destroyed by disease; or the semen is rendered unfruitful through disease of the excretory apparatus which under normal conditions stimulates the spermatozoa to greater activity. On the other hand, the semen may be normally produced in the testes and fail of excretion because of an anomalous condition of the excretory duct. Occasionally a severe illness may inhibit the activity of the gonads.

Perhaps the most favorable type is that due to constitutional syphilis. In this case antiluetic treatment will result in restoration of function. In luetic epididymitis local mercury inunctions over a long period, combined with the internal administration of potassium iodid, will be beneficial. In neurasthenics and in excessive venery long periods of abstinence are important. Morphin addicts require appropriate therapy gradually weaning them away from this pernicious habit. Cases of cryptorchidism have been benefited by early and timely operation in which the testes are given the chance of more or less mature development. In gonorrheal epididymitis attempts must be made to restrict inflammation. In chronic cases a well-fitting suspensory is of help. Wet dressings worn for a long time with the suspensory may soften up indurations and result in resolution. Daily changes of the solution are made. Iodin internally for months at a time also proves helpful in these cases.

Atrophic testicles are practically hopeless. Where the underlying cause is in the central nervous system nothing may be expected from therapy. In other cases electric stimulation is worth trying. The positive pole is applied to the back while the negative pole is placed on the testes. The current should be weak and applied for a few moments at a time.

Obliteration and stricture of the seminal excretory duct have been overcome by implantation of the vas deferens in the head of the epididymis as recommended by Martin. Several successes have been recorded but the operation is difficult and is followed more often by failure. It is certainly worth the trial in desperate cases where offspring are desired and any measure that will offer the slightest prospect of success is welcome. Deformity of the external genitals or neighboring parts may be corrected by operative measures. Hydrocele, hernia, infiltrates of the urethra, tumors of the scrotum may be eliminated by operation. Antidiabetic treatment is instituted in the hope that with general improvement will follow improvement in the special genital function.

Treatment of Impotence.—In general the therapy may be divided into psychic, general hygienic and medicinal.

Psychic Therapy.—In the psychic group, effort must be made to win the patient's confidence, he must be reassured and encouraged in the hope of an absolute cure. A thorough, earnest and conscientious effort must be made in the examination of the patient. Nothing appears to impress itself so favorably as taking the patient seriously. Finding some one in whom he can truly confide, the patient pours out his troubles perhaps for the first time. The patient suffering from impotence is prone to abandon all his friends, feeling himself doomed to perdition. The restoration of his confidence is the first step toward a cure. Telling the patient there is nothing the matter with him, according to Casper, leads nowhere and as a rule bears worse results. Account must be taken of the psychopathic patient and of employing suitable measures to meet his mental aberration. An important part of the psychic treatment is to engage him in work that shall occupy him most of the time, diverting his mind from his perverted trend of thought. This may be accomplished by keeping suitable company or by work. The latter may be secured in gardening, in gymnastics, bathing, swimming, walking, taking excursions into the country, etc. This tends also to give him sexual rest which he appreciates as very necessary to the reëstablishment of his sexual power. Eventually the latter is stimulated. Suggestion must play a great rôle here. The Coué formula is not without value in this class of cases.

Hygienic Therapy.—Diet should be nourishing and devoid of condiments and large quantities of spirituous drinks. These act as excitants and can do harm. Beer taken soon before bedtime appears to arouse masturbation and pollutions in those inclined toward these habits. Fatty things which stuff without being nutritious are to be avoided. Meats, fish, eggs and moderate quantities of flour form the chief part of the diet. Gorging is bad because it causes restless sleep and this in turn induces erotic thoughts. A soft feather bed promotes the tendency to masturbation. The patient must avoid lying on his back, because this tends to cause erections and pollutions. A filled bladder is very apt to cause these symptoms. Occasionally this takes place at a certain hour. Therefore it is advisable to arouse him by an alarm clock, say an hour before its wonted occurrence. Eight hours' sleep is essential. In those who have previously dissipated, early going to bed is now necessary. Obstipation tends to cause prostatorrhea and spermatorrhea, therefore requiring laxatives, etc. Exercise of the body must be considered essential in those leading a sedentary life—regular gymnasium work for those who can do it and massage for those who cannot.

Other measures are baths, electricity, topical applications and internal administration of tonics. The sponge, sitz, half and full baths are recommended. The best type bath consists of luke-warm to cold-water

bathing followed by spinal douches. Carbon dioxid and oxygen baths are stimulating. Galvanic, faradic and franklinization currents are useful in some cases. The modus operandi is not understood. Bier hyperemia may also be found useful in the psychically impotent.

Topical Applications.—Heavy metal sounds beginning with a No. 18 Charrière and increased to No. 26 to No. 28 and even to No. 30 every third to fourth day. The object of the metal sounds is to dull the sensibility of the urethra. However, when these are allowed to remain for one-quarter to one-half hour, they may arouse erections. Irritation of the pars prostatica of the urethra by 1 to 2 per cent silver nitrate solution with the Guyon syringe has been found useful. The best way is to introduce the bougie as far as the cut-off muscle of the bladder and, as the bougie is being withdrawn, the silver solution may be injected. Precise topical applications may be made by the urethroscope. This measure is to be undertaken, however, only when the colliculus and its neighborhood in the prostatic urethra is inflamed.

Internal Drug Administration.—The internal administration of drugs to influence impotence is varied. Casper mentions only those which, as experience teaches, have borne good results. Tinct. cantharides 3 to 8 minims t.i.d. is recommended. Its action is through increased blood supply to the genitals, but occasionally inflammation results from the drug; also pollutions and masturbation.

Hammond combines strychnin with phosphorus as follows:

℞ Zinci phosphorat. 0.6
Ext. nuc. vomic. 2.0
M. et div. in pill No. 100.
Sig. One, t.i.d.

He claims that the phosphorus acts as a nerve tonic and hence its favorable effect upon impotence. Another prescription is:

℞ Strychnin sulph. 0.2
Acid hypophosphor. dilut. 120.0
M. et Sig. 10 drops t.i.d. and increase to 25 drops t.i.d.

Atropin in doses of .0025 to .005 gm. two to three times daily, until eye symptoms appear, has been employed by Casper with good results. The action according to Gross is that it inhibits contraction of the corpora cavernosa and therefore allows the greater supply of blood to the penis; besides it causes dilatation of the vessels.

Hormin, consisting of testes, thyroid, hypophysis and pancreas, 3 to 6 tablets a day, has also been recommended. Testicular extract given intramuscularly and intravenously (Ivan Bloch) is more problematic. Finally the Steinach treatment has been resorted to in the treatment of impotence. But from the viewpoint of fecundity naturally only one vas is to be ligated.

CHAPTER VI

THE NON-SURGICAL TREATMENT OF GYNECOLOGICAL DISEASES

A. N. Creadick

Disorders of the female generative tract relate, primarily, to the functions for which it was designed, secondly, to the venereal infections, and, in the third place, to the interrelation between the genital tract and other organs, or groups of organs. These diseases may be congenital or acquired, and certain well-standardized and conservative surgical procedures for their relief are established, but the indications for immediate surgical intervention are not always well understood. Furthermore, recent advances in biochemistry, glandular therapy and in non-specific protein therapy have enhanced the importance of non-surgical treatment of these conditions. There remain two indications for a review of the subject (1) operative relief may not be offered sufficiently early; or (2) when operation is contra-indicated or unnecessary, the physician may not be acquainted with the useful non-surgical procedures which are available.

The lesions affecting the generative organs may be discussed in the order of their appearance during life. For instance, the disorders apparent at birth or shortly thereafter include infections, tumors, and the more obvious congenital abnormalities. At puberty an absence or delayed appearance of the menstrual flow, profuse menstruation, failure of development of the sex organs and lack of secondary characteristics may be noted. During early sexual life the infections are common. Besides these, dyspareunia, sterility, concealed developmental defects, displacements and obstruction due to tumors come to the physician's attention. The largest proportion of gynecological diseases is associated with pregnancy and includes ectopic gestation, abortion, puerperal infection and injuries and displacements of the generative organs. The incidence of malignant neoplasms is increased after the thirtieth year. From a diagnostic viewpoint it is essential to ascertain whether the symptoms in a given case first appeared in coincidence with birth, puberty, marriage, childbirth, injury, or the menopause. Likewise, in obtaining a history, certain relevant complaints such as pain, leukorrhea and disturbances of menstruation, point to the generative system. Subsidiary symptoms are backache, intestinal disorders and disturbances of micturition.

Pain.—The patient usually ascribes any pain between the umbilicus and knees to a pelvic disorder and it is for this symptom that she most frequently consults her physician. However, careful history-taking will elicit other signs that occasionally antedate the onset of pain. The character, location and radiation of the pain are of the greatest significance and the patient is directed to indicate the site of origin and direction of radiation. Pain due to a pelvic disorder may be altered or relieved by recumbency, may be aggravated by exertion or by coitus, and may be exaggerated during the menstrual period. In the patient's own words, the intensity, intermittency, location, radiation, duration and possible cause should be listened to attentively, in order that significant facts may be elicited.

Pain in the lower quadrants of the abdomen, especially on the left side, is more common in women than in men. This pain, usually ascribed to the ovary, may have no relation to the pelvic organs whatever, but may be due to cecal constipation on the one hand or on the other to sigmoidal distention or to tuberculous colitis. True ovarian pain is more deeply seated in the iliac fossa nearer the anatomical site of the ovary, radiates backwards through the corresponding sacro-iliac synchondrosis and occasionally downward into the corresponding thigh. True ovarian pain may be caused by retention cysts of an endometrial character, or of follicular origin, or may be due to a distended corpus luteum. Such pain may vary considerably in intensity. Prolapse of the ovary into the culdesac is frequently accompanied by disturbing symptoms, especially during coitus, while torsion of the broad or ovarian ligament will cause constant sharp and incapacitating pain.

Uterine pain is deep in the pelvis and usually in the midline, localized by the patient "at the bottom of the stomach." It radiates backward through the rectum to the sacrum, thus producing typical uterine backache. It is usually dull in character but more often intermittent, due to spasmodic contractions of the uterus, such as are described in dysmenorrhea. The recumbent posture frequently brings relief, whereas long-continued standing aggravates the condition. All sacral or lumbar backaches are not uterine in origin; and a patient presenting the symptom "backache" must be studied from three points of view. The uterine, which has just been described as corresponding to the attachments of the uterosacral ligaments, is most common. Secondly, backache may be due to postural defects, sacro-iliac strain or lumbago, and usually is associated with the mobility of the lumbar or dorsal vertebræ. Thirdly, typical renal backache is associated with pain in the costovertebral angle, which radiates to the vulva.

Occasionally pain alone is not pathognomonic and therefore should be treated only after a diagnosis has been made. Symptomatic relief when obtained through the use of anodynes may confuse the diagnostician as to

the real character of the disease. One such instance involving the nicest differential diagnosis rests between appendicitis, right-sided pyelitis and tubal inflammatory disease. In this type of case ice-caps applied to the abdomen of the patient, who is kept in Fowler's position, will alleviate the symptoms without aggravating the underlying condition. Meanwhile the further diagnostic studies may be completed.

Pain may be associated with complications of pregnancy, the most important of which is ectopic gestation. In this condition the onset and character of the pain, its localization and its intermittent character are of importance. Then, too, incomplete abortions are associated with typical uterine contractions, resulting in pain. Therefore, the presence of an abnormal intra-uterine or extra-uterine pregnancy should always be borne in mind when pain manifests itself as a prominent symptom during the childbearing period. Abdominal pain is a constant symptom in cases of an ovarian cyst with torsion of the pedicle as well as in premature separation of the normally implanted placenta during the latter half of pregnancy. In both of these conditions, a tumor mass can be outlined on palpation, but the differential diagnosis requires some skill. A severe degree of pain may also occur in atresia of the vagina, in dysmenorrhea and in the late stages of neoplastic disease. When present with myomata the pain usually depends upon a degeneration of the tumors or upon the association of pelvic inflammatory disease. When present with carcinoma, symptomatic relief may be secured by the administration of narcotics.

Treatment of Pain.—In addition to the warning in regard to the use of narcotics, it is likewise advisable to defer purgation until the diagnosis is made. Cases of intestinal obstruction, appendicitis, and other similar and confusing conditions are aggravated by the administration of purgatives. In cases of localized or generalized peritonitis, or in those cases which show a peritoneal irritation, without a definite pyogenic infection, it is best to localize the condition and keep it localized by immobilizing the intestines. Therefore, stimulation of peristalsis is to be avoided, and dependence placed upon low simple enemata when it is necessary to secure an evacuation. In acute conditions it is always best to depend on ice-packs and Fowler's position to palliate symptoms until the diagnosis is certain. Many surgeons decline to operate on acute pelvic inflammatory disease until the temperature has subsided and a relative immunity has been acquired. In the meantime, the expectant method of treatment hastens this favorable period. On the other hand, there is a constant danger in the expectant treatment of acute appendicitis. Consequently an accurate diagnosis is of primary importance.

Leukorrhea.—Discharges from the vagina other than blood may be serous, mucous or purulent, and may be related to exercise, menstruation, copulation, or childbirth. Facts concerning the character of the discharge must be elicited with care, for the personal equation is important, one

patient noticing lesser degrees of leukorrhea than another. It is likely to be more annoying to the nulliparous, while marked degrees of leukorrhea are frequently disregarded by the multiparous woman. The discharge is cervical in origin in nearly all cases. Vulvovaginitis in the child and senile vaginitis are exceptions. Incontinence of urine and serous discharges from adenocarcinoma of the body of the uterus must be distinguished from cervical exudates. Desquamated epithelium from the vagina and the external genitalia are commonly present in the discharge, which may be increased by quantities of organisms normally present in the canal. The leukorrhea of the serous type is largely due to chronic passive congestion or malignant disease; that of the mucous type to displacement and chronic infection; while the purulent type denotes acute and subacute infection, usually of the cervix. These discharges may excoriate the vulva, chafe the inner surfaces of the thighs, and are frequently associated with a pruritus, which is annoying to the patient. The first or serous type is not amenable to local treatment, but the major conditions should be treated, after which the discharge will subside. Treatment of the mucous discharges of the more chronic nature is obstinate, is directed toward replacement of the malposition, or removal of the chronic infection of the cervix. The purulent discharges are particularly difficult to handle, non-specific endocervicitis in the nullipara being most resistant to treatment.

Menstruation.—While the menstrual function is regarded as evidence that the individual is capable of childbearing, instances are recorded in which pregnancy has occurred before the appearance of the first catamenia, and after the menopause is supposed to have supervened. The relation of ovulation to menstruation, the influence of the corpus luteum and the histological changes in the endometrium throughout the menstrual cycle are more clearly appreciated since the work of Hitschman and Adler, Frankel, and others. "Premenstrual swelling" or an hypertrophy of the uterine mucosa, accompanied by edema, congestion and increased size and tortuosity of the corporeal glands takes place every lunar month as the graafian follicle matures, ruptures and forms the corpus luteum. If fertilization of the ovum occurs, this change in the uterine lining is preparatory to implantation, but, if the ovum escapes, there occurs a discharge of the edematous mucosa, together with a bloody and serous exudate. This loss represents about 50 c.c. of a viscid, non-coagulable serosanguinous material, usually darker and more purple than venous blood. This excretion persists normally from four to five days, at first profuse, and of a dark color, subsequently subsiding and assuming a paler hue.

Mild subjective symptoms usually accompany the menstrual period, a prodromal group of hypersecretion and activity of all the physiological functions. This is succeeded by breast symptoms of weight and tingling, headache, constipation, polyuria and a congestion of all the pelvic viscera

translated as a "bearing-down" sensation. Once the flow is established these symptoms are relieved and, while at first general bodily activity is limited, at the conclusion of the period a sense of well-being is rapidly reëstablished. The accompanying chart of the von Ott curve (Fig. 1) demonstrates graphically the periodic depression of metabolism and bodily

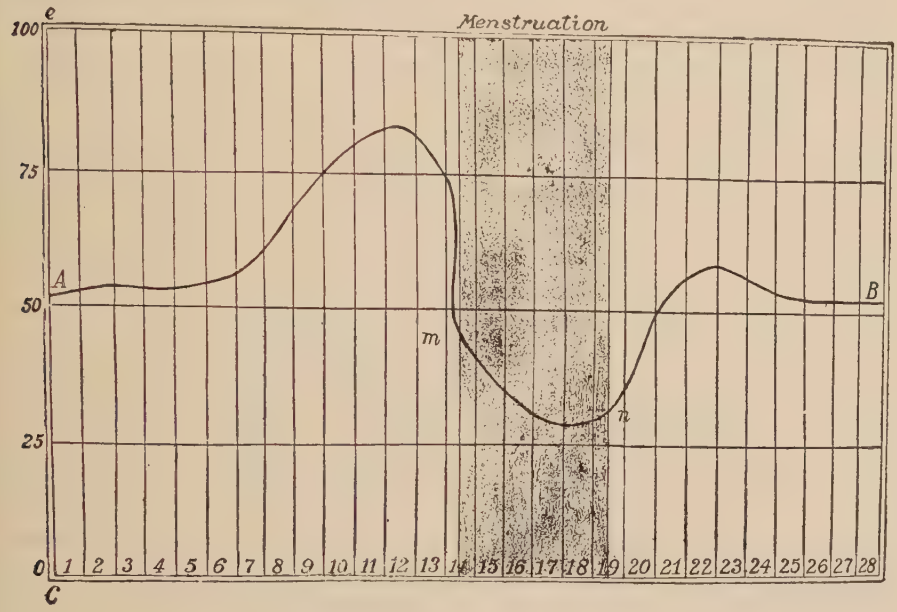


Fig. 1.—The Curve of von Ott.

functions coincident with this menstruation. It is true that this curve was based on crude clinical observations of blood-pressure, temperature, pulse rate and "muscle power." Likewise it has been used by various authors to substantiate Goodman's "wave theory." In details the findings have not always been corroborated by subsequent investigators, but the curve still remains a graphic representation of functional activity.

DISTURBANCES OF MENSTRUATION

Abnormalities of menstruation may be grouped under amenorrhea, dysmenorrhea, menorrhagia and metrorrhagia. Irregularities of menstruation in the absence of definite local pathology indicate some constitutional disease, the most frequent cause being some disturbance in the correlated activity of the ductless glands. From puberty onwards, such disturbances require prompt attention, in order to cope adequately with the functional disorder before more or less permanent effects are produced upon the organs themselves or upon the mental equilibrium of the patient.

Amenorrhea

The term "amenorrhea" usually refers to a sudden cessation of the flow that has normally been established. Obviously, the outstanding causes for amenorrhea are physiologic, namely, pregnancy, lactation and the menopause. For this reason, in every case whose chief symptom is amenorrhea, the possibility of pregnancy should be borne in mind and that cause at once eliminated.

In some cases there may be a delay in the appearance of menstruation at puberty, which may be due to hypoplasia of the generative organs. On the other hand an obstruction, such as an atresia of the vagina, may prohibit the escape of the menstrual flow. The latter condition, however, is not an amenorrhea, but rather a failure of the flow to appear.

In 87 per cent of cases which have been recently delivered, there is a physiologic amenorrhea during the first six months of lactation. In general, the conditions other than pregnancy which produce amenorrhea may be local or constitutional. The constitutional diseases include chlorosis, severe chronic infections, such as tuberculosis, secondary anemia following profuse hemorrhages, and acute upper respiratory infections such as influenza and bronchopneumonia. Sudden changes in living conditions, particularly changes in residence which involve marked alterations in climatic conditions and altitude are reputed to produce an amenorrhea of short duration. Periods of famine increase the incidence of amenorrhea, and the importation of young women from rural districts and outdoor life to strenuous urban factory or mill work likewise gives rise to a considerable number of cases of this disorder. Ample proof of these facts was offered during the Great War.

Treatment.—In order to obtain successful results from treatment, it is necessary to consider the cases from the broad viewpoint of diet, habits, occupation and environment by which the general health may be maintained or improved. Aside from the general requisites of fresh air, good food, and a moderate amount of exercise, iron, arsenic, laxatives, cod-liver oil and glandular therapy are beneficial.

Because the intestinal tract in chlorosis and other anemias is easily disturbed, great care must be exercised in the administration of drugs. Iron by mouth is effective only when in the form of nascent ferrous carbonate, which is best exhibited in the form of the classic Blaud's pill. The disadvantage in employing this remedy is pharmaceutical. Many preparations are ineffective by reason of a heavy coating or are so old that the iron is reduced or is no longer assimilable. Ampules of iron citrate or colloidal iron are available for hypodermic injection, and this is probably the most certain method for administering the drug.

Arsenic to be effective must be given in intermittent series—Fowler's solution by mouth, beginning with 5 drops three times a day, and increasing 1 drop a day until 15 drops three times a day are taken. This course covers about four weeks, following which an interval of two weeks to a month is advised. The course is then repeated, beginning with the smallest dosage. Neuritis and herpes are signs of too prolonged arsenic medication. Intermuscular injections of sodium cacodylate are quickly effective, and more readily controlled by the physician. A judicious combination of iron and arsenic gives better results and is preferable to the administration of either drug alone. After apparent improvement repeated treatment is necessary in succeeding spring and autumn months, before the condition is wholly overcome.

Partly by reason of the upset gastro-intestinal tract and partly by reason of the effect of iron upon digestion, these patients must be watched carefully, lest they become constipated. Active purgation is not desirable, but a sufficiently laxative diet, with the addition of aloin or phenolphthalein, is essential to promote a regular habit. Frequently a saline is superior to other laxatives, especially during the administration of iron. If such a laxative is desired, granular sodium phosphate may be prescribed in graded doses, so that too copious watery evacuations are avoided, and a daily result is obtained.

A certain number of these patients, though anemic, are apparently well nourished. Some may show varying degrees of dystrophia adiposo genitalis. To such patients, thyroid extract and pituitary extract may be given in small doses, and, unless symptoms of hyperthyroidism supervene, continued over a space of several months. To the thin, anemic, nervous girl, especially if there are symptoms of increased basal metabolism, or if any other sign of excessive thyroid secretion is present, further administration of thyroid extract is obviously dangerous.

The patient who suffers from scanty and irregular menstruation, who is obese and not anemic, who is depressed, has frequent headaches, and complains of pelvic pain, may be relieved by the administration of thyroid extract over a long period of time, together with ovarian extract for a week before the period is expected.

The use of drugs as emmenagogues is of little value. As a rule, they are drastic enough to cause an irritation of the gastro-intestinal tract or of the kidneys, without producing the desired effect on the uterus.

Acute suppression of the menses with severe pain, cramps and peritoneal irritation, may arise from exposure to cold. The clinical picture occasionally resembles that of extra-uterine pregnancy and a careful pelvic examination is indicated to rule out the latter condition. Rest in bed, hot applications to the lower abdomen, and warm vaginal douches (120° F. in the bag) of sterile water, may be given twice daily. Any of the antispasmodics, preferably benzyl benzoate, 1 dram in water or milk, may be ad-

ministered. Under unusual circumstances, even ½ gr. of codein sulphate may be given hypodermically by the physician in person.

Dysmenorrhea

Pain associated with the menstrual period may occur before the onset of the flow, or may accompany the first show of blood, or may not be noticed until the flow is well established. Efforts to classify the causes of dysmenorrhea on an anatomical or pathological basis have not been successful, for no adequate anatomical factors have been found to establish the etiology. This system varies in degree from the mild manifestations so frequently encountered to the very occasional case of complete prostration requiring narcotics or hysterectomy. The condition is relatively much more frequent in the better educated and highly cultured, city-bred classes than it is in the rustic and working classes. A somewhat crude clinical classification on the basis of physical signs may prove useful:

1. The "spasmodic" type, common in the nulliparous, and without gross pathology.
2. The congestive type, occurring in the parous woman.
3. The obstructive type.
   a. Membranous dysmenorrhea.
   b. Dysmenorrhea due to "flooding" and clots from obvious pathology.

The so-called "spasmodic" type is misnamed, for the pain is located deep in the pelvis, in the midline, and is of a constant gnawing character, with occasional acute colic. It is doubtful if uterine contractions are causative. Menstruation usually exists for two or three years before pain is prominently associated with it, but let the individual enter in an academic competition, move from an open-air, rural life to an urban office or mill occupation, or suffer in surroundings that tax her psychic reserve, and typical symptoms supervene. Coincidently, symptoms not associated with the pelvis arise, such as nausea, vomiting, headache, fainting and violent evacuations of the bowels.

Etiology.—With this condition, so common and incapacitating, one would expect that marked deviations from the normal anatomy would be palpable or altered histology observed. This is not the case and in a large proportion of such patients nothing abnormal can be discovered in the pelvis. Of course, it is well known that individuals do not respond uniformly to equal stimuli, and what will cause pain in one is ignored by another. Even the same individual will suffer at certain times more acutely than at others. Similarly, these patients will have considerable discomfort one month and in the succeeding months have no symptoms of a general character whatever. Furthermore, on examination, a nullip-

arous condition of the uterus is usually found, characterized by a conical cervix, with pin-hole os, and acute anteflexion of a small, poorly developed body. For many years the condition was ascribed to acute obstruction. At the time that the congestion is most marked, it was supposed that the uterine mucosa obliterated the internal os at the sharp angulation. This point of view is no longer tenable, for similar findings can be made out in a large proportion of those women who do not suffer from dysmenorrhea. Because a certain proportion of these cases were relieved by dilatation, certain others by marriage, and nearly all by subsequent childbirth, apparent support was lent to the obstructive theory. On the other hand, obstructive symptoms are always colicky in type, should be accompanied by muscle spasm, which would result in hypertrophy of the uterus and an obvious hematometra or hematosalpinx. No such muscle hypertrophy nor such retention of the menstrual exudate is demonstrable in these cases.

Two theories have been advanced as to the possible origin of this pain: (1) that it arises from some ovarian secretion, or from some specific secretion in the uterus itself, concomitant with menstruation. And (2) that it depends upon pressure due to increased tissue tension in the uterine body itself. It is well known that whenever such increase of tension occurs, either in the presence of an inflammation or simply from ecchymoses in the denser tissue, pain is a prominent symptom. These characteristics are both fulfilled in the endometrium just before the onset of the menstrual period, in that the edema and congestion is most marked just before the endometrium ruptures on its surface. This, peculiarly enough, is just the time when the pain is most likely to be severe. It is also evident that the general congestion in the pelvis coincident with menstruation will aggravate any other pelvic condition which may be present—for instance, a subacute salpingitis and congestion in a normally atretic ovary. Furthermore, in addition to suffering from dysmenorrhea, a number of these patients are sterile.

It is apparent that the ultimate etiology of this type of dysmenorrhea, which is so common in the nulliparous patient, and which is unassociated with physical signs, is not understood. Why one young woman should have severe pain, which incapacitates her from her ordinary activities for two or three days of each month, while another is not subject to noticeable discomfort or interference with her work; or why the symptoms are not equally distressing to the same patient in succeeding periods cannot be explained.

Again, the pain may not occur until menstruation has been established for two to three years. It may begin with a sudden change in the girl's social existence. It is usually initiated in the more highly cultured classes by attendance upon academic contests; in other cases by bad hygienic influences, or it may be coupled with some severe constitutional or nervous

strain. Therefore it seems obvious that this type of dysmenorrhea will not find its ultimate etiology in the pelvic organs alone.

There is one type *associated with nervous symptoms* of an hysterical nature and "ovarian" pain, which deserves special mention because it is extremely intractable to treatment. It has been commonly ascribed to a chronic inflammation of the ovary. Such a pathological entity is in doubt, and the evidence submitted is insufficient to warrant such a diagnosis, for this condition is not the result of a truly inflammatory process. Both these types of dysmenorrhea are commonly associated with sterility. This occasionally is overcome at the same time that the dysmenorrhea is relieved by drastic dilatation. It is very doubtful if the curettage which is performed at the same time is of real benefit. However, one has the opportunity of examining the lining of the uterus microscopically for the possible discovery of a distinctive pathological change.

Probably the second largest group of cases of dysmenorrhea is that of the *congestive type* so commonly seen in the parous woman. This is an aggravation of the bearing-down sensation experienced by so many at the time of the monthly period, and is uniformly due to an increased amount of blood in the pelvic structures, involving the cecum, sigmoid, and adnexa, as well as the uterus itself. The pain is distinctly of the uterine type, and consists of a heavy sensation from the symphysis back to the sacrum, thus producing the typical uterine backache. Frequently this pain is relieved by recumbency, though tenderness may persist over the area of the uterus. This type of dysmenorrhea is common in cases of endometritis, metritis, subinvolution and retroversion, and occasionally accompanies myomata. It is not to be confused, however, with the dysmenorrhea associated with menorrhagia, which is so commonly a symptom of displacement, subinvolution and myomata. Synchronously with menstruation, hyperemia and congestion commonly increase the pain caused by tubal disease, and frequently excite a subacute pelvic inflammatory disease to an acute exacerbation, with localized peritoneal irritation. Properly classed under this heading is the pain which arises at the menstrual period, due to the endometrial cysts found occasionally in the ovary, which have been described by Sampson. The lining of the cysts resembles endometrium and the menstrual exudate is confined, thus producing considerable pain. This pain, which usually does not occur before the thirtieth or thirty-fifth year, may be regarded as acquired dysmenorrhea.

The third group is *obstructive dysmenorrhea.* True obstructive dysmenorrhea, in which the pain is colicky in nature, intermittent in character, and typically uterine, is frequently seen. This pain simulates that of the first stage of labor, begins in the back and radiates under the symphysis. The obstruction may be real or relative; real, when the axis of the internal os is actually occluded; and relative when the menstrual exudate is clotted and its escape obstructed. Real obstruction may be

associated with an imperforate hymen or a cribriform hymen. If not located at the outlet of the vagina, the obstruction is probably due to drastic operative or escharotic procedures upon the cervix. Real obstruction is comparatively rare, and may follow plastic operations or the use of too strong silver nitrate, phenol, or the actual cautery. Relative obstruction is a not uncommon disease, and is frequently spoken of as membranous dysmenorrhea, which is characterized by an exfoliation of a portion of the uterine mucosa. Upon examination under the microscope, the exfoliated cast is seen to consist of fibroblasts and endometrial cells, desquamated epithelium and fibrin.

Finally, dysmenorrhea may depend upon the presence of clots not containing connective tissue elements or epithelium, but occasioned by a submucous myoma, retroposition, or cardiac decompensation. In the presence of these lesions the uterine cavity becomes filled with clotted blood, which is expressed by contractions, causing the patient to suffer severe intermittent pain.

Treatment.—The effective treatment of dysmenorrhea depends on the type of the disease evidenced in the particular case. Careful local and general physical examination will identify the cause of the dysmenorrhea, following which suitable therapy may be instituted. Change of occupation, habits of life, or place of residence may cause and likewise may stop the nulliparous dysmenorrhea. Of these etiological factors, those associated with occupation are by far the most frequent at the present day. Confinement indoors, standing for long periods of time, as in the case of shop girls and mill workers, and unusual home activities may aggravate the dysmenorrhea. These factors are of particular importance at the time of the menstrual period.

As a rule, in the general asthenic state, dysmenorrhea is an early symptom. Here, then, is the proper key to adequate treatment. General hygienic directions, particularly as to the occupation during the week immediately preceding the onset of the menstrual flow, the requirement of fresh air, moderate exercise and thorough evacuation of the gastrointestinal tract, are essential. Of the exercises required in the out-of-door air, walking is the best. Such active sports as tennis and horseback-riding would be beneficial, but are only useful for those patients who are accustomed to such activity. Besides, they are not available for the poorer classes. If exercise increases the patient's appetite and prevents constipation, it is beneficial; whereas, if such activity brings on fatigue and disinclination for food, it should be dispensed with at once, and rest should be substituted. So far as drug therapy is concerned a laxative, a mustard foot-bath, or even a hot foot-bath with sea salt has for a long time been popular with the laity.

The use of "cramp bark" and gin, while sanctioned by time, has not proved effective or safe. One should always bear in mind that, by the

use of alcoholics or narcotics at this time, a habit is easily formed. Of the antispasmodics benzylsuccinate, because of its dry form and low toxicity, may be judiciously administered. The coal-tar products are cardiac depressants, and should be administered guardedly. Their use, therefore, should be safeguarded by the addition of camphor and caffein. One formula which has proven useful consists of a capsule containing 3 gr. of phenacetin, 2 gr. of camphor monobromate and 1 gr. of caffein citrate, taken every three hours until relieved, or until three are taken. In extreme cases, when operative procedures are imminent, codein may be used, but should be administered in single doses by the physician.

Dilatation for the relief of dysmenorrhea is a popular procedure. However, there is no uniformity of result and it is questionable whether the advantage gained is permanent. Such a procedure can be done under anesthesia without injury to the hymen, the branched dilators being more efficient but not so well graded in size as the Hegar dilators. In a nullipara the anterior lip of the cervix is seized with a double tenaculum and a small dilator inserted to institute the first dilatation. This can be followed by the introduction of the typical Goodell dilator and slow dilatation effected in each quadrant. This dilator is equipped with a scale on the handle, which shows the amount of dilatation secured. The procedure should be done slowly, for the cervix is easily lacerated when the dilatation is too rapidly performed. Another source of error consists in dilating the external os while the internal os is unaffected. For married women there are numerous stem pessaries provided, both of hard rubber and of glass, or of wire, which may be inserted and worn for some time. These have considerable disadvantage by reason of the fact that, in the presence of infectious organisms in the vagina, chronic endocervicitis, or even salpingitis, may result. The best procedure is the use of the metranoikter of Schatz, or the Hirst modification of that instrument. This four-branched spring dilator is introduced into the cavity and allowed to remain for twenty-four hours; following its removal the dilatation is more likely to be of permanent value than the single instrumental dilatation previously described.

For the second or congestive type of dysmenorrhea, malpositions are largely responsible. Subinvolution, chronic infections and small myomata likewise are regarded as etiological factors. Therefore appropriate treatment for these conditions may be instituted. Those cases not requiring or not suitable for operation are often relieved by manual reposition of the uterus and the usual methods of depleting local congestion. Among the latter are hot douches to cause a temporary hyperemia, the use of strong hygroscopic tampons of glycerin, or ichthyol and glycerin, and the use of hydrastis or ergot in the intervals between periods. Without pharmacologic proof of its activity, hydrastis is empirically prescribed for the congestive type of pelvic distress and the success of many "quack"

remedies is based upon this, or upon a similar drug. However, the danger lies in administering such a remedy routinely to all patients, without subjecting them to a thorough physical examination. In this way both the physician and patient are occasionally lulled into a false sense of security, and the favorable period for operation is missed.

Acquired dysmenorrhea in women of thirty or over, particularly if accompanied by sterility in the preceding few years, is suggestive of the endometrial cyst of the ovary described by Sampson. These cysts continue to produce a secretion similar to the uterine menstrual flow, and may rupture, the escaping contents becoming implanted in the culdesac of Douglas. This lesion is often overlooked and is only relieved by a total extirpation of both ovaries. This is the only condition in which it is justifiable to remove the ovaries for dysmenorrhea, a conservative procedure being equally effective in the other cases.

Membranous Dysmenorrhea.—While a certain amount of uterine mucosa is frequently lost at the menstrual period, following certain inflammatory conditions of the endometrium, the entire cavity may exfoliate a part of its mucous membrane intact. The severe uterine spasm is relieved by curettage, but recurs from time to time thereafter. Frequently a cast of the whole uterine cavity, consisting of mucous membrane and clot, may be extruded with violent uterine contractions. Of all the recommendations for the relief of this condition, potassium iodid and Fowler's solution stand out preëminent, suggesting that from an empirical point of view the condition is not a local one, but is associated with some systemic disorder.

Mittel-schmerz.—There has been described a severe pain which occurs at regular intervals midway between the menstrual periods. It is ovarian or uterine in type, and has been called middle-pain, or intermenstrual pain. It is supposed that this pain is coincident with ovulation; indeed, occasionally such patients may at the same time see a single spot of blood escape from the vagina. If there is an inflammatory condition of the adnexa connected with the pain, it should be appropriately treated. Other cases will be relieved by the less drastic methods of treatment mentioned under Dysmenorrhea, for instance, the sitz-bath, the use of viburnum and hot applications applied externally.

Menorrhagia

The use of the term "menorrhagia" for an excessive menstrual flow, and metrorrhagia for intermenstrual bleeding, has been sanctioned for a long time. Nevertheless, it must be remembered that these are not disease entities, but merely symptoms of some underlying pathological condition. The normal menstrual period usually lasts four days and requires about four changes of napkins for each day that the flow is active.

Individual variations occur which must be elicited in taking the history. Some women bleed longer and more excessively than others. Therefore, in interpreting these symptoms the physician will bear in mind the personal fastidiousness of the patient in caring for the discharges, as well as the frequency and duration of the flow previously experienced.

When the blood loss coincident with the menstrual flow is excessive, it may be due at puberty to an improper balance between the glands of internal secretion; in middle life to some local condition, such as a myoma, a retroversion or subinvolution; and later in life, to chronic cardiac disease, or to a pathological lesion within the uterus, such as carcinoma.

Menorrhagia of Puberty.—When the onset of menstruation is announced by a profuse and continual blood loss, protracted in some cases for as much as three weeks, it is probably due to an autonomic imbalance. Rest in bed is of first importance. Further, calcium lactate may be administered over a short period of time, gr. x, three times daily, or thyroid extract, gr. ½, three times daily. If these measures are not successful, mild radium treatments are usually completely satisfactory. Possible functional disorders from the last-mentioned treatment are not yet clear, for sufficient subsequent pregnancies in patients so treated have not been reported. Whether radium produces a disastrous effect on a subsequent enlargement of the uterus is not proved. It suffices to say that the upper limit of dosage for this type of case is 400 mg. hours. Little is known of the subject of calcium metabolism, but Blair Bell and Wright have accumulated sufficient data to lead us to believe that there is a deposit of calcium before the onset of the menstrual period. If calcium lactate is given over a long period to a patient with menorrhagia, the exact opposite of the desired result is reported. Therefore, the administration of calcium lactate should be of a week's duration, followed by a rest interval of that length or longer before the subsequent dose. A certain number of these cases in my hands have responded very satisfactorily to the use of corpus luteum extract, gr. v, three times daily, just before the expected period is due. After four or five days of such therapy the period appears. As soon as it is well established, moderate doses of thyroid extract are given, and at the fourth or fifth day of the period a normal cessation of the flow occurs.

A certain number of unmarried patients suffer from menorrhagia late in life. This is usually relieved by thyroid extract. Similar treatments with thyroid and ovarian extracts may cure sterility and moderate hypoplasia of the internal generative organs in obese patients with profuse and prolonged menstruation. Menorrhagia, like dysmenorrhea, may diminish after marriage; and it has been suggested that the spermatic fluid may have a secretory influence as well as a specific function.

Myomata of the uterus may be submucous, interstitial or subserous,

and especially in the first two types may manifest themselves by a prolongation of the menstrual period. While these neoplasms rarely grow to appreciable size before the twenty-fifth to the thirtieth year, they frequently cause sterility or abortion. Myomata are frequently associated with tubal infections, pelvic peritonitis and occasionally with degenerative changes within the tumor itself. In the submucous type, the menorrhagia may assume alarming proportions, requiring transfusion of blood and a relief of the secondary anemia before the tumor can be removed by operation. If the tumors are subserous or pedicled submucous growths, they may be removed and the childbearing function preserved. In the majority of instances, however, hysteromyomectomy must be performed.

When a contra-indication to general anesthesia exists and the tumor is less in size than a four months' pregnancy, and when it is uncomplicated by infection or degeneration, radium and X-ray may be employed. This therapy will produce an artificial menopause and reduce the size of the tumor even if it does not remove it.

Usually an excessive loss of blood occurs when the uterus is in retroversion. This is particularly noticeable in puerperal retroversion, prolonging the period of involution and increasing the blood lost during the first periods following delivery.

Further, repeated childbearing and malposition may result in a fibrosis of the uterine musculature, which presents no appreciable gross abnormality but which leads to an increased amount of blood loss late in life. The differential diagnosis between subinvolution, myopathic fibrosis and congestion due to chronic cardiac disease is established with difficulty. Chronic cardiac disease with venous stasis in the dependent portions of the body, and impending decompensation which is exaggerated on exercise and relieved by recumbency, quite commonly increase menstruation. The congestion of the uterus under these circumstances is responsible for the bleeding. Enforced rest and the use of digitalis, together with a reposition of any associated retroversion, is the only therapy required as far as the bleeding is concerned. If, however, such hemorrhages have caused a weakening of the patient and her response to the treatment just outlined is slow, radium may be used in sufficient dosage to bring about an artificial menopause. All evidence of local inflammation should be excluded before radium treatment is instituted. An anesthetic is not ordinarily required for the insertion of radium but, if nitrous oxid anesthesia can be tolerated, a preliminary diagnostic curettage should always precede the treatment.

Metrorrhagia

Metrorrhagia consists of bleeding from the uterus, independent of the menstrual flow. This bleeding is more likely to be less in amount and to occur at more frequent intervals, but may assume alarming proportions.

The source of the bleeding must be discovered at once and it is well to bear in mind that metrorrhagia is a symptom of the gravest importance which must not be ignored. In the first place, intermenstrual bleeding in young women may be associated with pregnancy; therefore it may signify that an abortion is threatened or inevitable, or that an incomplete abortion may have occurred with the retention of a portion of the product of conception. Chronic metritis, similar to the myopathic fibrosis mentioned, may cause loss of blood independent of the menstrual function. Uterine adenomata and cervical adenomata, commonly spoken of as "polyps," are frequent causes of bleeding of this character. Both polypoid and symmetrical hyperplasia of the endometrium increase the quantity of blood lost. Occasionally menorrhagia and metrorrhagia of mild degree are associated with chronic pelvic inflammation of a specific origin. Metrorrhagia, which is the most significant symptom of carcinoma, may be provoked by slight traumata resulting from exercise, the passage of a douche nozzle, and coitus (Fig. 2).

Nearly all of the conditions giving rise to metrorrhagia require immediate surgical interference. The bleeding may be temporarily controlled by uterine packing. Vaginal packing is useless, for, rather than stopping the blood loss at its source, it obstructs its exit, causing a hematometra or hematosalpinx. A uterine pack is difficult of application in that light is essential, the patient must be relaxed, and absolute surgical cleanliness is requisite. If these essentials can be fulfilled, such a procedure may be employed in an emergency in the patient's home, but should not be attempted when hospital facilities are available. In any event, the uterine pack should not be allowed to remain in place longer than twenty-four hours. The best of the local hemostatics, cotarnin hydrochlorid (stypticin), may be applied to the gauze pack, or may be given by mouth in doses of ¾ gr. three times daily. In addition, pituitrin, 2 gr., taken by mouth, or 0.5 c.c. injected subcutaneously will produce contraction of the uterine muscle. All these measures are preliminary to an examination under anesthesia and a diagnostic curettage. Specific directions for the handling of the cases due to infection, interrupted pregnancy and suspected malignancy will be given under those headings.

The Menopause

The functions of the female generative tract should be as smoothly physiologic as respiration or digestion, so that the onset of menstruation, pregnancy and the menopause should not cause any alteration in the mode of life of the patient. However ideally such activities should function, the climacterium or cessation of the generative life of the female is not often symptomless. Unfortunately the abnormalities that occur are too often ascribed by the patient, her friends, and even by her

physician to the fact that she is undergoing "the change of life." However, it should be remembered that there is always a pathological lesion behind the least of the symptoms, and that each is worthy of the most careful investigation.

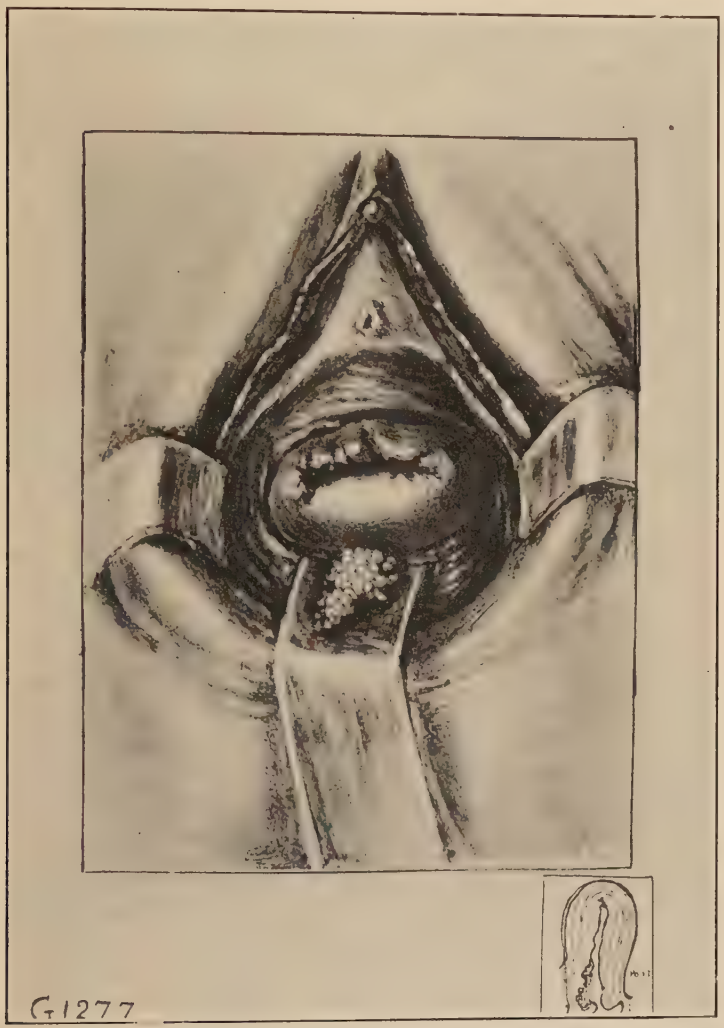


FIG. 2.—AN INNOCENT-LOOKING CERVIX, WHICH WAS UNDERMINED BY EXTENSIVE ADENO-CARCINOMA (SHOWN IN DIAGRAM BY THE INSERT). Symptoms of metrorrhagia of one month's duration.

Obviously, recurrence of bleeding is the most frequent complaint following an apparent cessation of the menstrual flow. Carcinoma is the commonest cause of this symptom, which, through delicacy or indifference, is frequently ignored. The risk of subjecting one patient to an

unnecessary examination or even to diagnostic curettage is no valid excuse for denying such measures to another at a time when prompt diagnosis is so vital.

For the nervous symptoms, "hot flashes," restlessness and palpitation, which occasionally manifest themselves at "the change of life," ovarian extract and triple bromids will suffice. At first such medication will be required at frequent intervals, later only at the time which corresponds with the menstrual period, and finally only on rare occasions of stress, overexertion or psychic strain.

RELATION BETWEEN THE GENERATIVE TRACT AND OTHER SYSTEMS

While emphasizing the criteria in the history and symptomatology which may have an important bearing on diagnosis and treatment, the correlation between the female generative tract and the various systems must be borne in mind. For instance, it is necessary to inquire carefully into urinary symptoms and to examine the urethra, bladder, ureters and kidneys to determine whether the condition is primary or secondary in the urinary tract.

The Urinary Tract

Painful and frequent micturition may be due to an infection of the urinary tract, to displacement of the pelvic organs, or to the presence of a growth in the pelvis; while loss of control of the urine may be due to neurosis, a spinal lesion, an atony of the urethral spincter, or may be associated with a prolapse of the uterus.

The examination begins with the inspection of the external urinary meatus for evidences of inflammation, for urethral caruncle or for malignancy. This is followed by an attempt to express purulent material by stripping the urethra. If this is successful, a smear of the material expressed is prepared, stained, and examined under the microscope. Later, the inspection of the urethra and bladder may be made through the cystoscope.

Urinary incontinence on coughing and straining may be due to atony of the urethral sphincter, which is commonly associated with cystocele and partial prolapse. Stricture of the urethra is less common in the female than in the male.

Diseases inherent to the bladder are objectively exemplified by irritation, reddening or even ulceration of the trigone and base. Examination of this area may be made in the office under surgical precautions through an air cystoscope. However, major therapeutic procedures had best be left to one more adequately equipped.

Papillomata, trabeculation, sacculation and spastic contraction may be demonstrated, as well as malignancy or malposition due to pressure from a pelvic neoplasm.

Cystitis and pyelitis are extremely common infections, but manifest themselves particularly in childhood, at puberty, and during pregnancy. They may be associated, also, with displacements of the uterus and senile changes in the generative tract. The organism most commonly found is Bacillus coli communis. This, in order of frequency, is followed by the staphylococcus, streptococcus, gonococcus and, rarely, by the pneumococcus and diphtheroid bacillus. Frequency, burning on micturition, and pain, together with the demonstration in the sedimented urine of clumped white blood corpuscles, accompany both conditions. A contamination of the urine by pus from the genital tract must be carefully avoided and, to exclude this, a catheterized, instead of a voided, specimen should be examined. Pus appears as a rule in "showers," intermittently, rather than uniformly in each specimen. After the diagnosis of pyelitis or cystitis is made, treatment is both general and local. Fluids are forced, and the patient is kept in bed. It is essential to examine the tract with the cystoscope and ureteral catheters, in order to locate the site of the infection and to isolate the particular infecting organism. B. coli is resistent to the ordinary urinary antiseptics, but does not thrive in an alkaline urine. Therefore, the administration of graduated doses of bicarbonate of soda renders the urine alkaline and relieves the symptoms.

Attention has already been drawn to the frequency of pyelitis and the difficulty of its diagnosis. The latter condition, and ureteral strictures with an accompanying intermittent or permanent hydronephrosis, are more common than had previously been thought. Examination of the kidneys is made with one hand in the costovertebral angle and the other in the corresponding upper lateral quadrant of the abdomen. Tenderness and enlargement of the kidney elicited by such external examination are suggestive of a renal origin for the pain, but ureteral catheterization and pyelograms are essential for a definite diagnosis.

Despite the fact that the specific action of hexamethylene tetramin (urotropin, helmitol) is not understood, when administered with acid sodium phosphate or sodium benzoate it relieves infections due to other organisms than B. coli. Methylene-blue may be administered internally, but its action is particularly annoying to the patient. The volatile oils are not efficacious. In many infections of the pelvis of the kidney or of the bladder, lavage or irrigation is necessary to effect a cure. However, these procedures should not be employed too frequently. A weak solution of potassium permanganate, boric acid, or plain salt solution, followed by the installation of mercurochrome, silver nitrate or colloidal silver salts gives the best results. In elderly women, in conjunction with the treatment just outlined, Basham's mixture is useful as an alkaline diuretic;

while in children and young women spirits of nitrous ether, or citrate or acetate of potash is preferable. Associated with most cases of pyelitis there is an infection of the bladder, and a more or less constant retention of urine. In cases of pyelitis associated with pregnancy symptomatic relief is obtained by forcing fluids and administering hexamethylenamin gr. v to x q. 4 h. Moreover, posture is of importance and these patients are more comfortable if recumbent upon the affected side.

A movable and palpable right kidney is present in nearly all women, particularly in those who are poorly nourished. In multiparous women with a general visceroptosis the organ may lie unusually low. Laxness of the anterior abdominal wall, loss of extraperitoneal fat, and absence of the normal lordotic curve of the spine are the primary etiologic factors in this condition. In many cases nephroptosis has been unjustifiably exaggerated in the eyes of patients and the profession. By itself, a movable kidney causes few symptoms and an operative suspension is inadvisable. A slight descent of the organ should be corrected by rest, forced feeding, abdominal and general massage, proper posture and exercise. Patients suffering from extreme degrees of visceroptosis are benefited by rest and forced feeding, combined with the exercises prescribed by Martin. For home exercises, a Bradford frame, elevated to the Trendelenburg position, is particularly useful.

Before concluding the section on the relation of the urinary tract to the genital tract, it is well to remind the reader that a distended bladder may be misinterpreted by the examiner. This distention may be "paradoxical"—in other words, while apparently voiding naturally, the patient does not entirely empty the bladder. Consequently, there is a retention of a considerable amount of residual urine, and that which is voided is merely an overflow. In all comatose patients, and in those with certain cord injuries, overdistention of the bladder is expected. Accordingly, routine examinations should be instituted to avoid this complication and catheterism employed every twelve hours, if necessary.

Gastro-intestinal Tract

The gastro-intestinal system is reflexly influenced by disorders of the generative tract. Frequently nausea and vomiting are associated with a physiological enlargement of the uterus, with incarceration or with degenerated myomata, but are more often occasioned by disorders of the intestinal tract. In distinguishing acute inflammatory conditions in the pelvis from gastro-intestinal disease, it is well to note that nausea and vomiting, or alternate periods of diarrhea and constipation more likely depend upon inherent diseases of the intestinal tract, such as acute appendicitis or colitis, than upon a salpingitis. Constipation, which may cause pelvic pain, may be due to adherent retroversion of the uterus, to an increased size of that organ, or to the presence of a pelvic tumor.

Treatment of pain due to the chronic type of intestinal stasis, chronic appendicitis, diverticulitis, or sigmoidal distention is accomplished by a dietary and hygienic regimen as well as by direct therapy. The usual method of procedure is to establish the habit, to massage the abdomen, and to regulate the patient's diet. The second step is to prescribe some simple lubricant, such as mineral oil, and lastly, when absolutely necessary, a laxative. The more bland the remedies and the more frequently altered, the less the likelihood of acquiring habitual constipation and dependence upon drugs. The National Formulary mixture of rhubarb and soda and the fluid extract of cascara fulfill all requirements. More active drugs are dry cascara products, to which aloin may be added, and lastly, the saline purgative usually reserved for the rapid aqueous extraction of toxic content in the bowel.

The dietary, prepared by my colleague, Dr. John P. Peters, Jr., is here reproduced. In addition to this diet list, the patient is given a daily routine including the hour for meals and explicit directions as to the proper method of massage of the abdomen to promote intestinal activity.

Constipation Diet

Foods Which Must Be Taken

Soups of all kinds.

Vegetables: Asparagus, spinach, corn, string beans, boiled onions, turnips, carrots, beets, lettuce, celery, sauerkraut, cabbage, brussels sprouts, cauliflower, salads and greens of all kinds.

Cereals: Oatmeal, corn meal, wheaten grits, hominy, shredded wheat.

Bread: Black, brown, oatmeal, rye, corn, graham, bran, whole wheat.

Desserts: Ice cream, honey, syrups, molasses, tapioca pudding and fruit puddings.

Fruits: Oranges, apples, peaches, pears, melons, grapes, cherries, berries, figs, raisins, stewed prunes and all cooked fruits.

Fatty Foods: Butter, cream, and olive oil.

Drinks: Water, buttermilk, orange juice, unfermented grape juice, olive oil.

Foods Which May Be Taken

Meats and Fish: All kinds of fresh meat and fish, if not fried or potted.

Vegetables: Peas, white beans, lima beans.

Desserts: Blanc mange and custards.

Drinks: One cup of coffee in the morning, cocoa.

Foods Which Must Not Be Taken

Meats and Fish: Fried and potted.

Cereals: Rice, barley, farina and gruels.

Breads: Hot or fresh white bread, fried bread.
Fruit: Huckleberries.
Cheese and nuts.
Desserts: Pastry and rich desserts, cakes and candy.
Drinks: Tea, alcoholic drinks, sweet or boiled milk, chocolate, more than one cup of coffee.

Eat a large breakfast, including a large portion of a coarse cereal.
Before going to bed eat figs, a dish of prunes or an apple.

This slip should be filled out by the physician in consultation with the patient and thoroughly explained to the patient, who must be directed to place it somewhere where his attention will be attracted to it frequently every day.

Constipation

Constipation is the result of bad habits.
The only way to cure it is to teach the bowel a new habit.
Do this by eating at the same time each day, and especially by having the bowels move at the same time each day.

Directions

.....Get up.
.....Drink two glasses of water, either very hot or very cold.
.....Begin the morning meal.
.....Go to the water closet and remain seated ten minutes.
.....Drink two glasses of water.
.....Begin the midday meal.
.....Drink two glasses of water.
.....Begin the evening meal.
.....Drink two glasses of water.
.....Go to bed.

In addition to the above directions massage the abdomen at least twice each day—just before getting up in the morning and just after going to bed—as follows:
Use the fist or a ball weighing 10 pounds.
Begin by pressing firmly in the lower right side of the abdomen.
Move slowly up as far as the ribs, then straight across to the left side, and lastly down the left side to the lower part of the abdomen.
Do this three times in a minute and keep it up for ten minutes.

The Skeletal System

Because the pain associated with uterine congestion and displacements is referred to the sacrum, "backache" is a frequent symptom of which the patient complains. However, since backache may arise also from structural defects in the vertebral column and from faulty posture, the orthopedist and gynecologist frequently meet in consultation.

[1] Hours to be filled in.

Included in the structural defects are general metabolic changes, such as rickets in infancy and osteomalacia in adult life, which have an important bearing on pregnancy and labor. Likewise toxic arthritis, or painful inflammation associated with abnormal bony deposits and "lipping" of the bodies of the vertebræ, is commonly seen by the gynecologist, by reason of the fact that the patient associates the condition with some minor pelvic abnormality. Toxic arthritis produces acute pain which is aggravated on motion. Rigidity of the spine is maintained by muscle spasm. The symptoms are relieved by recumbency, heat externally applied and by fixation. When the acute stage is passed, massage and postural exercises are employed.

Subluxations of the sacro-iliac joint cause pain in certain positions. The strain is greatly aggravated by protracted standing, is relieved by tight strapping or the application of a firm, circular binder over the iliac crests and trochanters. It is an orthopedic problem, but it is of passing interest to remind the physician that pain quite similar to sacro-iliac pain may be referred from the arch of the instep up the back of the legs to the sacrolumbar region. Occasionally these subacute joint inflammations require careful study, differential diagnosis and occasionally surgical treatment before they can be permanently relieved.

Of the more chronic structural defects which the gynecologist meets are the postural defects, which involve a long, vicious circle of undernourishment, bad posture, visceroptosis, nervous irritability and bad digestion.

In addition, myalgias and lumbar muscle pain are similarly located in the back. Renal pain, while definitely localized in the costovertebral angle, is frequently spoken of by the laity as "backache," and it is therefore necessary to study a patient with this complaint from all viewpoints. When the pelvic examination fails to reveal sufficient pathology to account for the symptom "backache," or the area affected is not of the typical pelvic character, it would be more logical to investigate the other systems before instituting radical pelvic surgery.

The Organs of Internal Secretion

Of late many authors have attempted to assign specific complex functions to each of the organs of internal secretion and to ascribe certain gynecological diseases to abnormalities of those functions. On a few shreds of proved fact an elaborate pharmacopeia has been built. Fortunately, a symposium on this subject, in which a number of eminent gynecologists participated, was held in 1917. The resultant discussion, interpreted by Ehrenfest and Graves, outlines the rôle played by each endocrine organ on the development and function of the generative tract, so far as we at present understand it. We have no proof of interstitial

secretory function in the human ovary after puberty. Fraenkel and Loeb have established the function of the corpus luteum in regulating ovulation, menstruation and implantation. The ovary, in addition, has a trophic influence on the genitals, mammary gland and secondary sexual characteristics. Complete absence of the internal secretion of the ovary in the young results in hypoplasia of the sex apparatus, and the failure of menstruation and secondary sexual characteristics to appear. Both physically and mentally the girl may demonstrate a certain degree of masculine characteristics. In the adult, loss of the internal secretion of the ovary causes a cessation of the function of the genital apparatus, exemplified by amenorrhea, sterility, and abrupt menopause, together with atrophy and retrogression of the external organs. There is a change in the general metabolism, usually associated with rapid gain in weight and a distinct change in the vasomotor system, marked by waves of heat, sweating and palpitation. No histologic lesions in the ovary commensurate with these symptoms can be demonstrated, but it is true that in such a patient the organ rapidly undergoes typical atrophic changes. Diminished but not absent function of the ovary may express itself in amenorrhea or scanty and painful menstruation, or as a sterility usually associated with an underdevelopment of the uterus and external genitalia. Alterations in ovarian secretion follow disorders of other units in the endocrine system, such as exophthalmic goiter, acromegalia, and Addison's disease. There is usually a preliminary period of hyperfunction of the ovary, followed by permanent ovarian insufficiency, hence the apparently varied ovarian difficulties, in the one case menorrhagia, in the other case amenorrhea, associated with these endocrine disorders.

Ovarian hyperfunction may be secondary to prolonged wasting constitutional infections, such as typhoid fever and tuberculosis. Hyperfunction of the ovary expressed by metrorrhagia, menorrhagia, or symmetrical hyperplasia of the endometrium commonly occurs shortly after the onset of puberty, early in sexual life, or just before the menopause.

In advising organotherapy for gynecological disease, the most important note is a warning against its use until a thorough examination has failed to reveal a pathological lesion. In no instance can gross or histological lesions be ascribed to "dysfunction of the endocrine glands." Infantilism, or a failure of the internal and external genitalia to develop normally, when associated with other skeletal evidences of puerility, may be relieved by administration of ovarian extract from the whole ovary of young animals. It must be borne in mind that this condition may be associated with alterations of function in the thyroid and pituitary glands as well. It also is true that this pathological picture may be due to chronic inflammatory processes localized in the pelvis itself; hence in no way primarily attributable to ovarian dysfunction.

Delayed Puberty

A failure of the normal corpus luteum to develop early in the sexual life of the girl may be ascribed to poor physical condition, climate, social condition, mental and sexual stimulation. In a small group of such cases, deficient corpus luteum and its antagonist, thyroid secretion, may be counterbalanced by the administration of extracts of these glands. Under the chapters on Menstrual Disorders and Sterility, the treatment of those conditions by organotherapy has been outlined.

The Central Nervous System

The time-honored association between the pelvic organs and neuroses or psychopathic states has been unduly exaggerated. These conditions may arise following a prolonged invalidism due to pelvic disease, but the emotional irritability existed before the pelvic disease manifested itself. When an individual with a hypoplasia of the generative organs, a displacement, or a teratomatous growth presents a neurosis or psychosis, it is rarely a case of cause and effect. Simple physiological menstruation may become a painful or incomplete procedure, due to the pelvic condition and to the neurosis. Undue importance is laid upon this abnormal menstruation, and from that time on the patient associates her depressed mental or physical state with some pelvic abnormality.

Graves describes "genital psychoneuroses" as of two types: one in which the mind reverts to imaginary ills in the pelvis—"genital neurosis of imagination"; the second in which actual pelvic disorders keep the mind attending on the pelvic symptoms—"the genital neurosis of overvaluation." Under suggestion controlled by a good psychiatrist, the first type can be cured. The second type should be properly cared for by the gynecologist and, if necessary, referred later to the psychologist.

The conception that insanity can be relieved by attention to pelvic disorders is absurd. When such disorders impair the general health of the patient, it is necessary that they be corrected, in order that proper hygienic and occupational therapy can be afforded, but to attribute relief of the dementia to the cure of the pelvic disorder is incorrect. These points were brought out effectively in the articles of Taussig and Gibson.

METHODS OF EXAMINATION AND DIAGNOSIS

A general physical examination of each patient who presents a gynecological condition is always indicated in order that the effects of chlorosis, tuberculosis, chronic cardiac insufficiency, structural defects and consti-

tutional metabolic diseases (diabetes) may not be overlooked. Without undue exposure, the examination should be thorough and should include successively the various parts of the body. Otherwise, valuable observations, such as the type of respiration, areas of pigmentation on the skin, small tumor masses and the exact localization of points of pain and of tenderness will escape notice. A tentative diagnosis made without examination, and the prescribing of empiric treatment to escape the embarrassment of a complete physical examination, is unscientific and dangerous. However, such an examination as has been suggested, following a definite order of procedure, rapidly becomes habitual on the part of the examiner.

Pelvic Examination.—Inspection and palpation of the genitalia should never be omitted from a physical examination. Young virginal women should not be subjected to bimanual physical examination of the pelvic organs except under anesthesia. In the more obvious conditions and in calm and phlegmatic individuals, a rectal examination without anesthesia is permissible and may be sufficient.

The pelvic examination is more readily accomplished in the lithotomy position, with the patient suitably draped. Preference for the Sims' position expressed by many gynecologists depends upon the lessened embarrassment to the patient, but unfortunately the position prevents adequate exposure of the vulva to inspection. It is especially favorable, however, for the application of tampons, while the knee-chest position is of assistance in the manual reposition of a retroflexed uterus. Rigid asepsis is unnecessary except in bladder, uterine or ureteral examinations. There is, however, grave risk of transmitting a venereal or a pyogenic infection from one patient to the next. Therefore, all instruments should be thoroughly boiled in a 1 per cent solution of bicarbonate of soda, dried and wrapped in a clean towel. Basins, douche cans, and syringes may be soaked in 1:1,000 bichlorid of mercury solution if they are injured by boiling. All gauze sponges, cotton balls, tampons, etc., should be sterilized in an autoclave and sealed until required for use. In order to protect other patients as well as himself, the physician should always wear rubber gloves, especially in obviously infected cases. These gloves should be kept in a solution of cyanid of mercury (1:10,000) and put on in this fluid and sterilized after use.

Preparation of the Patient.—Unless the condition is acute, the examination is facilitated by requiring an evacuation of the lower bowel before the patient visits the physician. In addition, the bladder should be emptied just before the examination.

Irritation of the urinary meatus, urethral caruncle, abscess of Bartholin's glands, atresia of the vagina and similar abnormalities can be determined by inspection better than by palpation. In cases of suspected infection, smears must be taken both from the urethra and from the cervical canal, before other instrumentation or examinations are undertaken.

Next, the vagina and the cervix should be inspected through a suitable speculum. Both Sims' and bivalve specula of assorted sizes and lengths are necessary for the proper examination of gynecological patients. Topical applications can be carried out most accurately through a Ferguson speculum. Illuminated specula are desirable, but, if proper headlights or direct light can be obtained, they are not essential. Occasionally a Kelly cystoscope or small proctoscope will aid in the direct inspection of the vaginal vault and the cervix of a virgin.

The third maneuver consists in an orderly estimation of the contents of the pelvis by bimanual examination. The first two fingers of one hand are inserted into the vagina, while the fingers of the other hand make counterpressure on the patient's abdomen. The elbow corresponding to the internal hand should be rested on the thigh or against the pelvis of the examiner and all pressure applied from his body or thigh, reserving the unimpaired tactile sense for the fingers of that hand. The external hand on the abdomen holds the pelvic viscera against the internal examining fingers, and each pelvic organ is mapped out in order, the cervix, the body of the uterus, the adnexa first on one side and then on the other, and, finally, the examination and outline of tumors or attached masses.

Instrumentation, such as the insertion of a uterine sound or inflation of the tubes, should be reserved for the expert. However, the manual and instrumental correction of a non-adherent retroflexed uterus, the insertion of pessaries, tampons and topical applications, form an important part of the physician's daily practice.

DYSPAREUNIA

Among the commoner functional disorders of the female generative tract is dyspareunia. Painful or difficult coitus may be caused by: (1) attempted penetration in the presence of some local irritation; (2) local obstruction; or (3) a spasm of the circular muscle without demonstrable local lesion.

Local irritations, such as vulvitis, inflammation of Bartholin's gland, ulceration, urethral caruncle, kraurosis, or atrophy of the introitus (the last only occurring after the menopause), may cause dyspareunia. The treatment consists in alleviating the particular cause. Coitus should be interdicted in the interval lest a neurosis, which would require considerable time and patience to overcome, be superimposed.

The local obstructions include tumors of the vulva, imperforate hymen, rigid cartilaginous ring about the fourchet, absence of the vagina, cyst of the vagina and similar rarer lesions. The treatment of these conditions is essentially surgical.

Hyperesthesia and spasm of the vagina and levator muscles may in-

duce a neurosis or psychoneurosis resulting in utter abhorrence of physical contact. To this spasm the term vaginismus has been applied. The underlying etiological factor may be apprehension or a trivial lesion causing temporary tenderness. This type of dyspareunia appears in the period before sexual excitement has been experienced. In treating such cases, copious use of a lubricant such as vaselin may be all that is necessary. Common-sense advice to the husband in regard to gentleness and restraint will frequently prevent a grave psychoneurosis from supervening in the wife. Occasionally, after a period of sexual rest, 10 per cent cocain may be added to the lubricant formerly prescribed. If this fails, glass dilators, well lubricated and of graduated sizes, may be worn for a time and finally a plastic operation may be required.

Once overcome, this condition does not recur after delivery, but poor apposition of the mucosa after perineorrhaphy may leave little tender tabs of redundant mucous membrane which later cause dyspareunia. By touching these with a silver nitrate stick all further difficulty may be overcome.

Too little attention has been paid to these problems, owing to the delicacy of the patient and the physician in discussing them. However, serious marital differences may result, and it has been stated that many divorces are remotely due to some difficulty in sexual relations which might have been avoided had the physician given a sympathetic ear and good advice of a hygienic nature.

PREGNANCY

The importance of the diagnosis of pregnancy must always be borne in mind when making a gynecological examination. For obvious reasons the patient's story may be misleading. The classic suggestive signs of pregnancy, particularly the secondary changes, such as Chadwick's sign, the presence of colostrum in the breasts, secondary pigmentation of the areola, etc., can be simulated by certain pelvic disturbances. Likewise the presumptive signs, such as Hegar's sign (Fig. 3), and Braxton-Hicks' contractions, cannot always be conclusively elicited. Subinvolution, especially associated with retroversion, at times cannot be distinguished from an early succeeding pregnancy. Unless absolute signs of fetal heart tones and fetal "small parts" are demonstrable, the physician should always make successive examinations at not less than two-week intervals before definitely committing himself to a diagnosis of pregnancy. That this is not an imaginary differential diagnosis is proved by such vividly descriptive names as "crying myomata" and similar self-explanatory terms applied to tumors. If pregnancy is suspected, applications of strong solutions to the cervix, the use of hot vaginal douches and all intra-uterine

manipulations are contra-indicated. It is equally important to recognize the commoner complications of pregnancy, such as abortion, extra-uterine pregnancy, hydatidiform mole and chorio-epithelioma.

Abortion.—Extrusion from the uterus of bright blood which rapidly clots, independent of the menstrual history, should arouse the suspicion of the attending physician that an abortion is imminent or incomplete. Lacking evidence that the accident is inevitable in the presence of uterine cramplike pain associated with bleeding from the cervix, the diagnosis of threatened abortion may be made. Every effort to quiet the symptoms and permit the pregnancy to proceed is justifiable in this condition. Such measures include absolute rest in bed, no catharsis, and free prescribing of codein or morphia to arrest the expulsive cramps.

Fig. 3.—Eliciting Hegar's Sign (Williams).

It is rarely possible to demonstrate the loss of amniotic fluid before the onset of hemorrhage. If such evidence is available, or an abortion of the fetus or a portion of the membranes can be demonstrated, any efforts to quiet the condition are useless and spontaneous completion is uncertain.

Under these circumstances, the present pregnancy is terminated. If the patient can be confined to her bed and watched carefully, complete extrusion of the remainder of the product of conception may occur spontaneously; or its expulsion may be stimulated by the injection hypodermically of 0.5 c. c. doses of pituitary extract and by a hot enema. The expectant treatment of such incomplete abortions is not, as a rule, safe, for the degree of bleeding can reach alarming proportions. There are two accepted methods for dealing with such cases, and the physician should be guided by his ability and by the available hospital facilities in choosing between these two. First, under thoroughly aseptic precautions, folded gauze may be inserted through the patent cervical canal until the uterine cavity is firmly packed. This is allowed to remain for twenty-four hours, when it is slowly withdrawn, at which time the entire product of conception usually comes away, adherent to the gauze. Obviously, the dangers in this procedure are that the cavity is not tightly packed, so that serious hemorrhage may still occur behind the plug of gauze. It is likewise a difficult procedure and is associated with the possibility of an intra-uterine infection.

The second, and far more efficient, method of treatment consists in the digital removal, under anesthesia, of all the product of conception from the cavity of the uterus, followed by one copious hot intra-uterine irrigation. The use of sharp curets or thin forceps to remove the contents of the uterus is extremely dangerous, for the risk of spreading infection or perforating the wall is increased. If the abortion has taken place some weeks previous to the operation, and the cervical canal is firm and not dilated, and the retained product small in amount, it is occasionally necessary to dilate the cervix and use a large, blunt loop to effect complete removal of the partially organized decidua. Otherwise it is safer not to use any instrumentation whatsoever.

Extra-uterine Pregnancy.—A patient who has had a low-grade pelvic inflammatory disease, whose last pregnancy occurred some time before, and whose last menstrual period occurred six weeks or more before she consults her physician, may suddenly be attacked with a sharp, lancinating pain in either iliac fossa, severe enough to cause her to faint and, on the subsidence of the syncope, nausea and peritoneal irritation are demonstrable. Such a patient has suffered a rupture of the tube within which a fertile ovum has become implanted. There is always associated intraperitoneal hemorrhage which may cause the death of the patient. This condition represents a true gynecological emergency, and the best treatment is immediate laparotomy.

If such clear-cut examples as this just cited were constant for the condition, the correct diagnosis would be made more frequently. The condition should be recognized before rupture of the tube or abortion from the fimbriated end actually occurs. When the patient consults her physician because the menses are a few days overdue, and on bimanual examination an exquisitely tender sausage-shaped mass can be felt in either lateral fossa connected with the uterus, tubal pregnancy should be regarded as likely. Operation may be deferred, provided the patient is kept under the closest observation until the diagnosis is certain.

Much the more frequent experience is that the physician is called to see a patient presenting the typical picture of shock and a history pointing to a ruptured abdominal viscus. Such patients show marked degrees of blood loss, and the picture is so grave that examination or transportation may dislodge a clot and prove fatal. Morphia, hypodermoclysis and binding of the extremities with a spiral bandage may be useful in the emergency until the patient can overcome the primary shock and reach a well-appointed operating room.

More rarely, an abortion has occurred from the fimbriated end of the tube or a rupture has taken place within the folds of the broad ligament, associated with less severe intra-abdominal hemorrhage. Under such circumstances the picture may not be so striking, and the symptoms during the succeeding days be incapacitating but not alarming. The patient com-

plains of a hot weight pressing on the rectum. Bimanual examination reveals a tender, boggy mass on one side of the uterus, with some distention of the culdesac by a crepitant spongy mass.

In some instances the preëxisting localized pelvic inflammation may act as a barrier to the escape of a large amount of blood into the general abdominal cavity. Again, the escaping fetus and membranes may occlude the site of rupture and limit the degree of bleeding. At any rate, instances have been reported of a limitation of the active process which results in an incarceration of the pregnancy and a calcification of the fetus, leaving an innocuous mass, discovered only at a later period (lithopedion).

The placenta may remain attached to the tubal mucosa, the broad ligament or the serous surface of the uterus, and the fetus may be extruded into the abdominal cavity, where it goes on to term. This outcome, like the lithopedion formation, is of interest and extremely rare, not to be expected or awaited, but may occur when the primary rupture has escaped diagnosis. A term abdominal pregnancy is delivered by cesarean section; the gravity of the condition arises from the attempted detachment of the placenta which may give rise to fatal hemorrhage.

Hydatidiform Mole.—During the routine examinations in the early course of pregnancy, the physician may notice an unusual development of the uterine tumor, not commensurate with the menstrual history. This will at once suggest either hydramnios or hydatidiform mole formation. Slight bleeding may occur, especially at the time corresponding to the menstrual period, and in the discharges may appear round, glistening, cystic bodies the size of peas. These cystic bodies are portions of chorionic villi which have undergone myxedematous degeneration and cyst formation. Extensive degeneration of the chorionic villi is inimical to nutrition of the fetus, and may cause its death and absorption. Penetration of the uterine wall by the overgrowth of the villi weakens the structure and occasionally rupture of the uterus occurs. When the diagnosis of hydatidiform mole is established, the pregnancy should be regarded as terminated and the growth removed.

Chorio-epithelioma.—During implantation, the fetal portions of the protecting membranes known as the trophoblast liberate a tryptic ferment and penetrate the maternal mucous membrane. At the time portions of trophoblast may penetrate the maternal blood sinuses and be transported through the body by the blood-stream. Occasionally, also, after abortion or following delivery of the placenta at term, portions of the trophoblast may persist, remain in the uterine wall and undergo malignant degeneration. Profuse hemorrhages are the first subjective signs, while objectively metastatic implantations may be observed about the cervix or vaginal walls.

The condition does not resemble other malignant growths. First, the growth is by direct extension and the metastases are not local but

rapidly involve the lungs and the brain. Secondly, early metastases are reported to have disappeared after the primary growth has been removed. Nevertheless, the rapidity of the growth is remarkable, diagnosis is based on microscopic examination of the curettings, and a panhysterectomy should be undertaken as soon as the diagnosis is made.

INFECTIONS OF THE FEMALE GENERATIVE TRACT

Chronic diseases of an infectious origin such as syphilis and tuberculosis may manifest themselves in a peculiar manner when attacking the generative organs. Then, too, a group of acute bacterial invasions of the pelvic viscera, such as the gonorrheal and wound infections, are of particular significance.

Fig. 4.—Chancre of the Vulva.

Syphilis. — Primary syphilitic lesions are rarely observed on the vulva or cervix (Fig. 4). In the first place they seldom cause subjective symptoms requiring the patient to consult a physician and, in the second place, they may be hidden in folds of the labia or vagina or be disguised by gross lacerations or by inflamed areas. Secondary manifestations, known as condylomata lata, are more constant and are definitely diagnostic. They are white, plateaulike elevations of the stratified squamous epithelium modified by the moisture in this region. These lesions are more frequently seen because they persist for some time and are sought for when doubtful secondary lesions elsewhere on the body need confirmatory evidence. Tertiary lesions are relatively more common, especially in the cervix, where the condition resembles a new growth. Frequently the

differential diagnosis is made only after histological studies or a serologic or therapeutic test.

The lesions of syphilis and the treatment of the disease in the female do not differ materially from those in the male, but certain peculiarities in the infection when associated with the generative function require special mention. In the first place the mode of transmission from male to female is not always evident, because the primary lesion may be within the cervical canal or even higher in the tract. The offspring is infected and, while it is not always certain that the mother is infected first, in the vast majority of cases maternal infection can be proven by the complement-fixation test. Many British syphilographers and gynecologists, notably Routh, regard syphilitic infection of the mother and of the fetus as a cause of many abortions. It is more widely agreed that, while the influence of syphilis in the first trimester of pregnancy is uncertain, it is undoubtedly one of the commonest causes of premature labor. Furthermore, approximately one-third of all stillbirths are due to syphilis. When the infection of the fetus does not result in death in utero, the child nevertheless is infected, weakly after birth, therefore less likely to survive.

Again, it is of interest to note that repeated pregnancies following syphilitic infection show a diminishing effect on the fetus somewhat after the following order: (*a*) premature stillbirth; (*b*) term, dead born; (*c*) undernourished term child, with manifest evidences of congenital syphilis; (*d*) apparently healthy child, but subsequently showing latent syphilis. It is likewise noteworthy that women who have syphilis and who subsequently become pregnant apparently are less prone to experience marked tertiary manifestations of the disease. This is especially true of lesions of the central nervous system which are less frequent than in males and unmarried females. Efforts to combat the influence of syphilis on women during the childbearing period, and to prevent the incidence of congenital lues, should begin with a routine complement fixation test on each expectant mother. There is no contra-indication to treatment with salvarsan during pregnancy; indeed, there is every reason to push the treatment to the limit of tolerance. Even insufficient treatment will provide a living fetus, though it will not guarantee one free from syphilitic stigmata. In so far as possible, the intensive treatment of syphilis should be carried out before marriage is permitted. Syphilographers differ in the details of this treatment, but the permission to marry should not be accorded until at least three years have elapsed during which time the Wassermann test, taken at six-month intervals, is repeatedly negative.

Tuberculosis.—Infection of the female generative tract by the tubercle bacillus is not uncommon. The lesions may be external, similar to tuberculosis of the skin elsewhere on the body, modified by regional influences of moisture, heat, or maceration. These external lesions may be infiltrative or ulcerative and can best be diagnosed by biopsy. The lesions

may arise on the vulva or within the vagina, where they are inclined to ulcerate more promptly. Here the diagnosis is occasionally confused by reason of the presence of Döderlein's bacilli which are also acid-fast and difficult of differentiation.

Cervical lesions may be infiltrative, ulcerative or miliary, are best diagnosed histologically after light curettage, for which anesthesia is not necessary.

Endometrial changes are definite, usually miliary, but may result in a single caseous focus, can be demonstrated after curettage, and are resistant to treatment.

The involvement of the tubes and ovaries is practically always secondary to tuberculous lesions elsewhere in the body. The manifestations, both as miliary tubercles and as large single abscess cavities, are commoner in early adult life (though the contrary opinion has been expressed by the Mayo Clinic).

Etiology.—Considerable speculation in regard to the avenue of entrance has led to a number of interesting experiments and analyses of cases, all of which are reviewed by Norris in a very complete monograph on this subject. In 1902, Veit summarized our opinions at a symposium on Tuberculosis held in Rome: (1) Tuberculosis of the female generative tract is more frequent than was heretofore supposed. (2) It may exist as a primary form (direct invasion from an infected male), but the secondary form (dependent on lesions elsewhere, endogenous infection) is much the more frequent. (3) The infection is descending rather than ascending. (4) Spontaneous healing may occur (scar formation, atresia, sterility). (5) Primary lesions had best be extirpated and secondary lesions had best be let alone until the primary focus has had a chance to heal under general hygiene, rest, forced feeding, etc.

In view of the fact that the treatment is largely surgical, the condition is only mentioned for completeness, for its diagnostic importance, and by reason of its secondary complications. Any one interested particularly would be repaid by reading the articles by Dice, Norris and Williams given in the list of references.

Gonorrhea.—A gonorrheal infection of the genitalia of the fetus may be contracted by inoculation with discharges from the maternal tract during labor. In childhood the disease may be transmitted by the infected hand of the mother or of the nurse; while at any period the gonococcus may find entrance to the vagina during intercourse.

During infancy and childhood the infection does not extend to the cervix but is confined to the vulva, urethra and vagina, where it remains resistant to treatment and may persist until puberty. Irritation of the vulva of this character may lead to a fusion of the labia, or gynatresia, and the resultant obstruction escape detection until time for menstruation to appear.

Treatment of the infection in children involves meticulous care on the part of the doctor, the mother and the nurse. Daily external irrigations with boric acid solution (gr. x to ℥i), followed by instillation with a blunt medicine dropper of some colloidal silver preparation, such as argyrol (20 per cent), are required. Constant watchfulness against reinfection or transference of the infection from the vulva to the eyes is necessary, as well as the care of soiled clothing and the prevention of masturbation. In particularly obstinate cases specific vaccines have proved useful.

Fig. 5.—Abscess of Bartholin's Gland.

The physician rarely sees the initial stages of an acute gonorrhea in the adult female. In the first place the symptoms are more insidious and less annoying than in the male, and in the second place the patient is more reticent about consulting in regard to such complaints. However, it is not long before numerous foci such as the glands of Bartholin and those of the cervical canal produce pain and discharge which bring the patient to the physician for relief (Fig. 5).

It is rarely possible to eradicate the organism from the numerous glandular structures connected with the vulva and cervix. It buries itself in the mucosa and may invade the deeper tissues. In the subacute stages a blood-stream infection resulting in arthritis and occasionally in endocarditis may ensue. The disease rapidly becomes latent and an individual may acquire an immunity to the particular strain of organism with which she is infected. Under such circumstances a chronic gonorrhea may persist in a latent form throughout the period of sexual activity.

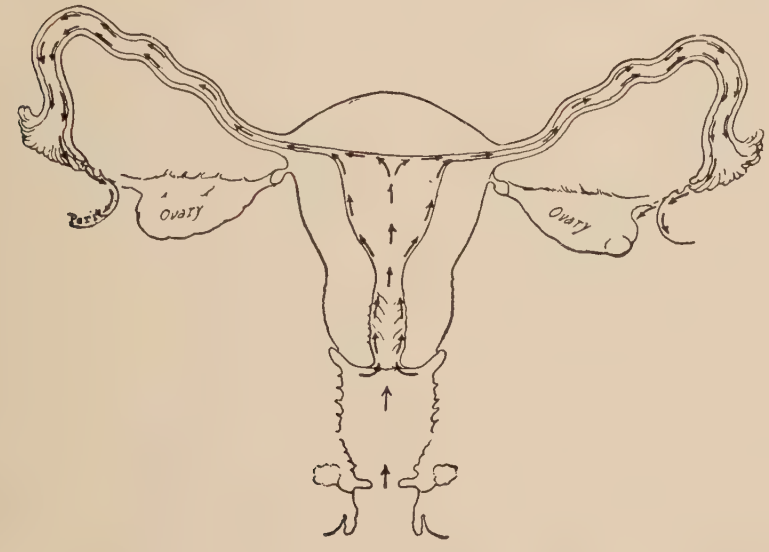
In chronic gonorrhea the infection usually remains limited to the mucous surfaces of the cervix and tubes. The anatomical changes in

those areas are not wholly due to the infection, but to the protective reaction which has been produced around the site of infection.

While the urethra is nearly always primarily infected, Bartholin's glands and the glands of the cervix may occasionally be the first areas involved. Careful questioning of the patients will prove that a large majority experienced vesical symptoms first, and in such cases rigid care during examination and treatment must be exercised to prevent spreading the infection to the cervical glands. In the presence of gonorrheal urethritis or cervicitis additional trauma may be necessary to drive the infection to the endometrium or endosalpinx. This requisite may be provided by abortion or childbirth—hence the frequency of ascending gonorrheal infection during the puerperium, which results in "one-child sterility." Evidence of such a complication following delivery is not presented until from the seventh to the tenth day postpartum; it involves the mucous membranes of the tubes, creating a localized peritonitis, which may seal the fimbriated extremity. These data serve to differentiate gonorrheal from pyogenic postpartum infection. In the latter the parametrium is involved on the third day postpartum, and a blood-stream infection may follow before signs of a spreading peritonitis can be elicited.

Before treatment is instituted, a positive diagnosis of gonorrhea must be made by the demonstration of Gram-negative intracellular diplococci in a stained smear. These smears should be taken by means of a platinum loop or sterile cotton swab from the urethra, the vagina and the cervical canal, at least three hours after urination and twenty-four hours after vaginal douching. The platinum loop and the glass slide must be free from oily substances. Therefore, the speculum, the physician's hands, the slide and swab should not have come in contact with a lubricant. In chronic infections it may be necessary to express the contents of the glands before a positive smear may be secured. In latent cases positive smears are only obtained in the first few days following menstruation.

Treatment.—Urinary antiseptics and copious irrigations with strong potassium permanganate solutions are at once indicated. In the acute stages argyrol should be freely used for irrigation, instillation or tamponade. In the chronic states mercurochrome or silver nitrate in 10 per cent solution should be applied. Skene's, Bartholin's, and the cervical glands may be cauterized or extirpated, if they persist as foci of infection. Involvement of the tubes and pelvic peritoneum (pelvic inflammatory disease) forms a large part of the surgical field open to the gynecologist.



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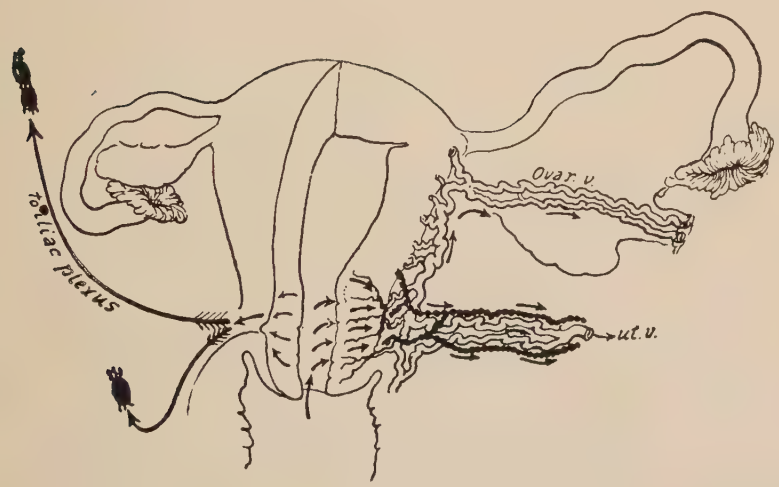

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FIG. 6.—THE DISTINCTION BETWEEN THE AVENUES OF INVASION (A) BY THE GONOCOCCUS; AND (B) BY PYOGENIC ORGANISMS IN PUERPERAL WOUND INFECTION. (From Anspach "Gynecology," J. B. Lippincott Co., 1922.)

PELVIC INFLAMMATORY DISEASE

Inflammation of the internal female generative organs, which may be acute or chronic and which may affect the tubes and ovaries or all of the soft structures of the pelvic cavity, is spoken of as "pelvic inflammatory disease." Such a general term is useful in clinical parlance, but at once becomes indefinite and inaccurate if the particular pathology is known. For instance, infection of the uterine muscle is properly referred to as metritis, while that of the bases of the broad ligaments should be termed parametritis. A diffuse involvement of the lymphatics, blood-vessels, and cellular tissue of the vault of the vagina, the broad ligaments or the ischiorectal fossæ is a lymphangitis, phlebitis or cellulitis. Salpingitis or oöphoritis may arise from an accumulation of the products of infection within the tube or ovary, or from an involvement of their peritoneal covering, and may be associated with a localized irritation of the adjacent peritoneum. These conditions are respectively endosalpingitis, perisalpingitis, perisalpingoöphoritis, and localized pelvic peritonitis.

The clinical course of infections differs so widely, depending upon the invading organism and the remote etiology, that the term "pelvic inflammatory disease" should be qualified according to causes: (1) postpartum or postabortal infection; (2) gonorrheal; (3) tuberculous pelvic inflammatory disease; and (4) that following specific endogenous infections, such as typhoid fever, small-pox and scarlatina.

Puerperal or wound infection may follow delivery at term, premature expulsion of the products of conception, or instrumentation of the pregnant or puerperal uterus, and causes a high morbidity among women during the childbearing years, as well as a very definite rise in the mortality rate. This disease is almost wholly preventable, and is due to the introduction of infectious material into the generative tract. The treatment is essentially preventive, while the remedial measures are largely medical.

Etiology.—The commonest organism responsible is the streptococcus; B. coli, the staphylococcus, various diphtheroid bacilli, pneumococcus, and B. aërogenes capsulatus follow in order of frequency. These organisms enter the uterine wall by inoculation, usually at a point of injury or at the placental site. The large thrombosed venous sinuses form a favorable nidus for growth. The organism travels along the thrombosed veins, the lymphatics and in the interstices of the cellular tissue directly to the broad ligaments and pampiniform plexus of veins, or it follows the course of the ovarian blood supply (Fig. 6). In the former, existence of diffuse cellulitis is demonstrable, while in the latter an ovarian abscess commonly follows. In the third place, the infection may penetrate the uterine wall and attack its serous coat and the adjacent peritoneum, thereby causing a localized infection in Douglas' culdesac, whence it may extend into the

general peritoneal cavity or may be walled off. Occasionally such a "pelvic abscess" may be evacuated or rupture into the rectum or the bladder. Endosalpingitis and pyosalpinx are comparatively rare, following puerperal infection.

The extension of the infection meets a definite wall of resistance, first in the uterine muscle and in each succeeding zone of lodgment. Its progress may be impeded by an opposing wall of leukocytes or, owing to its virulence or to meddlesome manipulations, the resistance may be overcome and the infection be widely disseminated. With the invasion of the blood-stream by the organisms or their toxins (bacteremia or toxemia) the infection may overwhelm the patient and cause death before the local evidences manifest themselves. On the other hand, the less virulent infections usually are associated with a series of local chronic lesions; acute endometritis, uterine abscess, cellulitis, broad ligament abscess, oöphoritis, ovarian abscess, peritonitis, localized abscess in the Douglas pouch or in either iliac fossa, or diffuse thrombophlebitis of the broad ligament, iliac and femoral veins.

Clinical Course.—The first clinical symptom may be deferred until from forty-eight to seventy-two hours have elapsed after the introduction of organisms. The history will usually connect that accident with some manipulation associated with pregnancy, labor, or the puerperium. The disease is usually announced by a chill, with a marked elevation of temperature, sometimes reaching 105° F. The leukocytosis of 10 to 15,000, which is normal for the puerperium, rises sharply to from 15 to 40,000. The pulse rate is disproportionately higher than the temperature curve. The onset of the symptoms may be more indefinite in the less virulent infections, so that there is a gradual daily rise in temperature and pulse rate, each evening reading being slightly higher than that of the preceding. The patient may complain of pain in the lower abdomen, or this symptom may be elicited only on palpation. Headache and lassitude are noted, followed by excitation and an elevation of the respiratory rate, if peritonitis is present and spreading. On examination, the physician is eager to find a focus of infection elsewhere than in the generative tract. However, it is obvious that careful inspection and palpation of the lower abdomen and perineum should ordinarily be done first in the presence of a rising temperature and pulse rate shortly following abortion or labor. The consultant may be deliberately deceived by the patient, but a soft, tender, boggy uterus, slightly larger than the normal rate of involution would warrant, together with pain, tenderness, or induration in either of the lower quadrants of the abdomen, is sufficient for a diagnosis. The period of onset is earlier than in gonorrheal pelvic inflammatory disease, and the degree of hyperpyrexia is greater. Examination of the perineum, vagina and cervix had best be confined to inspection. Repeated examinations of these patients by consultants is not infrequently the cause of further

extension of the disease. The discovery of an infected suture line, or necrotic areas on the perineum, vagina or cervix, may be sufficient to account for the symptoms.

As soon as the patient overcomes the initial invasion and the infection becomes localized, single or multiple areas of induration or fluctuation indicate abscess formation.

Prognosis.—Puerperal infection is always a grave disease, and the outcome is doubtful. Mild degrees of infection result in a prolongation of the puerperium and more or less invalidism. The underlying etiology frequently escapes recognition until the gynecologist relieves the patient's pelvic symptoms by surgical means. The ultimate outcome in cases of puerperal infection is hopeful in the majority of cases, particularly in those unassociated with meddlesome treatment, a perforation or rupture of the uterus. On the other hand, virulent infections may produce a septicemia, toxemia, spreading peritonitis and death with alarming rapidity. Of course, the prognosis actually depends upon the virulence of the infecting organism and the resistance of the patient invaded. A high leukocyte count indicates a favorable reaction against the infection, while a low count in the presence of severe symptoms indicates a lack of resistance. High fever, a notable increase in the pulse rate and severe toxemia, associated with few signs of localization, give an unfavorable prognosis. Blood cultures should be taken at frequent intervals. If these give negative results it is in the nature of a Scotch verdict "not proven," while if positive they have a definite prognostic value. The presence of the hemolytic streptococcus in the blood gives a dubious outlook. Few patients suffering from a blood-stream infection due to the staphylococcus recover. On the other hand, the prognosis for those in which the colon bacillus, which rarely invades the blood-stream, is the offending organism is more favorable. As soon as the infection becomes localized, the prognosis is better. Abscess formation in the culdesac, in either adnexal region or in the base of either broad ligament, may be drained by incision and is frequently followed by a diminution of the general symptoms, together with a subsidence of the induration. Thrombophlebitis may be difficult to discover, may extend to some distance, and offers a constant risk of embolus. Even after organization takes place and the risk of embolus is lessened, edema of the area distal to the thrombosis may cause distress and invalidism.

Treatment.—Obviously, the ideal treatment of puerperal infection is prophylactic. It is a preventable disease and the simplest means of avoiding it are: the requirements of surgical cleanliness on the part of the physician, nurse, and surroundings of the parturient woman; the reduction of internal examinations to a minimum; the omission of unnecessary meddlesome operative measures, and the prevention of contamination for some weeks after delivery.

By the time the clinical manifestations make themselves evident, the deep tissues have been invaded by the bacteria. Surgical treatment is of no avail until in more chronic stages in the localized areas pus has formed. Such abscesses can be evacuated by the simplest forms of procedure. Active treatment includes building up the resistance of the patient and abstaining from douches or meddlesome manipulations, which have a tendency to spread the infection. When first seen the perineum may show an infected suture line, in which case the sutures should be removed and the area swabbed with iodin. Any membranous exudate upon the vaginal surface may be likewise treated with iodin or carbolic acid and 95 per cent alcohol. Deep lacerations in the cervix, repaired or unrepaired, may be the site of entrance of the organisms, and should likewise be vigorously treated, to limit the infection. The quantity of lochia or its odor is of no assistance in differential diagnosis except that in general a foul lochia is a sign of a less virulent infection. A profuse lochia may be a sign of subinvolution, but may also be caused by a retention of a portion of the secundines. Under the strictest antisepsis palpation of the uterine cavity, to remove any placental cotyledon or fragment of membranes, may be permissible once, early in the course of an infection. Such a fragment is easily removed by wiping with a sponge wet with iodin or cyanid of mercury, 1 : 10,000, but in no case should an instrumental curettage be performed. Intra-uterine manipulations, irrigations or applications are meddlesome, and fraught with considerable danger. It is our custom to take an intra-uterine culture, palpate the cavity carefully, and give one copious intra-uterine douche (see page 163), which is the limit of interference. No intra-uterine antiseptic irrigation is of benefit, and a solution allowed to flow in under any degree of pressure serves to drive the infection before it.

The patient is kept in Fowler's position, with ice-bags applied to the abdomen over the fundus of the uterus. These maneuvers favor a limitation of the process to the true pelvis. No catharsis is given; on the other hand, an effort to allay active peristalsis and assist the bowel in walling off infection may be accomplished by the administration of small doses of codein or morphia. Small doses of ergot or quinin may be given for a tonic to the uterine musculature, to limit the spread of the infection and to express the contents of the uterus. By mouth small quantities of milk, in the form of eggnogs, and copious amounts of water are given. No solid food is allowed; even the milk should not be forced. After a few days, when the risk of a spreading peritonitis is less likely, daily small, simple enemata will empty the large bowel and additional nourishment may be offered when this is effected. The more simple, concentrated, nutritious and waste-free the diet, the better the patient responds. Drugs by mouth are contra-indicated, lest they irritate the stomach at a time when the latter must be kept in the most receptive condition for food. Digitalis,

strychnin, caffein and other stimulants are not indicated by the rapidity of the pulse, but may be reserved for tiding over an extreme toxemia or impending myocardial insufficiency.

Specific therapy has for the past ten years revolved around serum therapy, antiseptic dye injections and blood transfusions. The use of sera is still in an experimental stage. Promised successes have not been apparent because of a lack of specificity of the serum for the strain of organism concerned.

There have been numerous efforts made to cure bacteriemia by the injection of specific bactericidal dyes such as arsephenamin, acriflavine and mercurochrome. It is inadvisable at the present time to advocate the general use of such dyes intravenously. In the first place, we possess insufficient experimental evidence of a specific bactericidal property for these dyes. Moreover, their empirical success is based upon an insufficient number of cases.

Under present conditions non-specific protein therapy may prove useful, particularly in the subacute forms of infection.

The greatest contribution to the therapy of cases of puerperal infection made within the past ten years is the utilization of repeated small transfusions of human blood. A group of donors is secured and examined for specific complement fixation, and also grouped according to the Jansky method for isohemagglutination. In addition, it is safer to do a "direct match," even on cases that fall in the same group, to obviate occasional cross agglutination, which gives the patient such a profound reaction. From 200 to 500 c. c. of blood is removed by venipuncture from the median basilic vein of a suitable donor and collected into a flask, where it is mixed with sodium citrate to prevent clotting. After dilution with a small amount of isotonic salt solution, a similar needle feeds the citrated diluted blood into the corresponding vein of the recipient. Owing to the anemia and small blood volume of the latter, it occasionally is necesssary to expose the vein, in order to be sure that the needle delivers the whole quantity of blood into the vessel. The delivery of the citrated blood should be accomplished slowly.

Gonorrheal Pelvic Inflammatory Disease

In contrast to puerperal wound infection, gonorrheal infection travels directly along the mucous membranes successively involving the urethra, the mucous membrane of the cervix, the body of the uterus and the tubes (Fig. 6). The extension of the infection beyond the internal os, which acts as a natural barrier, is usually caused by trauma, and may occur after the menstrual period, after labor, or after any instrumentation of the uterus. Having passed the internal os, it is not long before the tubes become involved. Gonorrheal salpingitis is one of the commonest

disorders of the female reproductive system and its protean manifestations are due directly to the virulence of the original infection and to the difference in time interval that may elapse between the initial infection and its extension to the tubal mucosa.

When gonorrhea has been acquired coincidently with conception, it has active and severe local manifestations. Obviously, extension above the internal os does not take place until labor is concluded. Here, in distinction from puerperal infection, gonorrheal infection does not manifest itself until from seven to ten days postpartum, when the irritation of the pelvic peritoneum takes place. This is exemplified subjectively by pain and fever, objectively by tender masses in either iliac fossa and by distinct tenderness on release of pressure, more marked in the adnexal region than over the body of the uterus. The mucosa of the tube becomes edematous, congested, swollen, the epithelial lining is desquamated and the lumen is filled with pus. A portion of this infected material may escape from the abdominal ostium, resulting in an inflammatory reaction of the adjacent peritoneum, and the formation of an exudate. The ovary becomes infected secondarily, usually through a corpus luteum or a graafian follicle. The tube and ovary may become a large pus sac, adherent to the sigmoid, small bowel, broad ligament and uterus. The infected area is usually well walled off and rarely leads to a general peritonitis. The uterus falls posteriorly, by reason of the weight of the infected tubes, and confines the process in the culdesac. Frequently one tube is involved, but practically never to the exclusion of the other. Under appropriate treatment the condition may subside, although the patency of the tube is in most cases permanently lost and its function destroyed. Subsequent attacks, exacerbations of the primary infection, result from exertion, exercise, trauma, jarring and trifling injuries. In later stages the contents of the tube may consist of blood (hematosalpinx) or of a straw-colored fluid (hydrosalpinx).

If the interval between the initial infection and the transport to the tubal mucosa has been of longer duration and the individual resistance to the infection more highly developed, the involvement of the tubal mucosa may be less pronounced. The inflammation may subside and the lumen remain patent. The tips of the folds of mucosa may be thickened and glued together, producing the pathological picture known as "follicular" salpingitis. The latter lesion is commonly the cause of the arrest in the tube of a fertilized ovum.

The decision as to the possibility of preserving the childbearing function after acute gonorrheal infection is of the utmost moment to the attending physician. In rare instances of low-grade infection which has been overcome, subsequent childbearing is possible, but conservative surgery has not attained uniform success in restoring function.

Symptomatology.—Pain in both lower lateral quadrants of the abdomen, radiating down the inner surface of the thighs, made worse by exercise or the erect position, aggravated by defecation and accompanied by an elevation of temperature and pulse rate, suggests acute pelvic infection. There is usually frequency and burning on micturition, and on examination rigidity and muscle spasm of varying degrees in the lower half of the abdomen. These symptoms vary in degree, depending on the virulence of the infection and as a rule later exacerbations in chronic cases are less severe than the initial attack. These subsequent attacks frequently occur at the time of the menstrual period, may cause an abrupt cessation of the period or, on the other hand, prolong the flow. Symptoms referable to the gastro-intestinal tract are not pronounced, but nausea and diarrhea may occur. There is invariably a leukocytosis ranging from 10,000 to 20,000. Rarely chills are experienced.

Little can be gained by a bimanual examination, for the entire pelvis is tender, boggy and resistant to palpation. The several organs in the pelvis cannot be mapped out, but inspection of the urethra and cervix, together with microscopic examination of the discharges, may assist in making the diagnosis certain.

Attention has been called to the importance of differentiating an acute appendicitis from gonorrheal pelvic inflammatory disease. In the first place, gonorrhea is rarely unilateral, although one tube may be more severely infected than the other. In appendicitis gastric symptoms are more marked; the greatest tenderness is at the level of McBurney's point or just inside that line, while in the case of gonorrheal salpingitis there is little involvement of the intestinal tract; the leukocytosis is relatively lower, but the temperature is higher and the symptoms subside more rapidly under expectant treatment. It is more difficult to distinguish puerperal infection and gonorrheal pelvic inflammatory disease, although the systemic symptoms in the former are usually more pronounced. Fortunately, the history and the bacteriology may differentiate the two. Then, too, while it has been noted that puerperal infection may occur at any time during the first month postpartum, nevertheless the time of inoculation is usually during labor and the first manifestations of the disease occur within three days. On the other hand, more than a week must elapse for gonorrheal infection to extend to the pelvic peritoneum.

Treatment.—The treatment of acute gonorrheal pelvic inflammatory disease is never surgical. Under exceptional circumstances, the gonorrheal infection may not be differentiated from an acute appendicitis, and surgical intervention attempted on the latter assumption. If the physician leans towards the diagnosis of salpingitis and the condition of the patient improves under expectant treatment, she had best be let alone until all acute symptoms subside. During this expectant period it is essential to localize the infection and increase the patient's resistance. Young

women may be relieved of a series of these attacks in an effort to escape operative interference. The measures taken to quiet the patient include rest in bed, in Fowler's position, ice-caps to the lower abdomen, narcotics and hot douches. Catharsis is avoided and, when it is essential to move the bowels, dependence is placed on simple enemata. Evidence of pus formation can be elicited by watching the temperature curve and making occasional examinations. Too frequent examinations, however, arouse a quiescent lesion, evidenced by a rise in pulse, temperature and leukocyte count. When local abscesses are formed and areas of softening can be demonstrated, these can be evacuated by such simple measures as colpotomy or extraperitoneal drainage through Petit's triangle. If the patient can be cared for in this manner and lead a sheltered life, the generative organs, though impaired, may be allowed to remain. On the other hand, if the patient must lead an active life and care for her family or earn her own livelihood she should be given the benefit of active surgical interference, provided that the expectant treatment has resulted in a lowering of the temperature and leukocyte count to normal, together with a subsidence of the local signs for a period of seven days.

DISEASES OF THE EXTERNAL GENITALIA

Pruritus Vulvæ.—Itching of the pudendum may be due to external parasitic infection, to the excess of certain constituents in the blood or urine, to irritation from vaginal discharges, and to certain trophic diseases of the parts themselves. Under the first heading, ring-worm, pediculosis, itch mite and pin-worms may be mentioned. For tænia, Javel water (liquor potassii chlorinati) or sulphur ointment is specific. For pediculosis, ammoniated mercury ointment (grs. xxx to xl to ℥i), or a lotion consisting of bichlorid of mercury, grs. ¼, and glacial acetic acid ♏ xx, in water ℥i, will prove efficacious. For the itch mite, sulphur ointment at frequent intervals, together with thorough boiling of the soiled underwear, will cure the condition. Rectal irrigations with the infusion of quassia, ℥i to 1 pint of water, together with active purgation, relieve the patient of pin-worms.

Glycosuria is the commonest cause of pruritus due to abnormal metabolism. The presence of an unusual amount of bile and acid or urea also may occasionally cause temporary severe pruritus. Overdoses of morphin and alcohol are likewise ascribed as a cause of temporary pruritus. Rational treatment, therefore, begins with the removal of the etiological factor and not with local applications for the relief of one symptom.

Occasionally associated with retroversion, chronic cardiac disease, pregnancy, or uterine tumors, there is an excess of vaginal discharge, which produces considerable irritation and burning. This is particularly

noticeable in association with carcinomata and degenerating myomata. The itching is often intense, worse at night, aggravated by heat and exercise, and rapidly causes the patient to isolate herself and try all sorts of remedies. Scrupulous attention to cleanliness and the use of cotton pads to prevent the skin surfaces from chafing, with copious irrigations of solutions of baking soda and borax two or three times a day, followed by thorough drying and dusting of the parts with zinc oxid or zinc stearate may afford relief. In more severe cases, hot applications of lead water and laudanum may be applied while the patient is lying in bed.

For the trophic disorders where no obvious pathology can be made out, mild erythematous doses of X-ray will cure. The literature is full of unpleasant remedies which only serve to prove how obstinate the condition may be.

In *kraurosis,* especially in elderly women, there takes place a whitening induration of the labia minora and fourchet, which is accompanied by a severe pruritus. These cases cannot be subjected to X-ray without risk of necrosis and sloughing. Underlying this condition there is probably a loss of blood supply attending upon the menopause and the atrophy of all the pelvic organs. When the general applications described for pruritus have proved of no avail, and no source of irritation can be discovered in the urinary or generative tract, surgical extirpation of the external genitalia may be necessary to prevent a psychoneurosis.

Condylomata acuminata.—These are due to uncleanliness or irritating discharges, and are commonly, though not necessarily, associated with gonorrhea. They consist of sharp, warty excrescences, which become confluent, forming a cauliflowerlike mass over labia, fourchet, anus and perineum. They favor the regions moistened by the discharges and spread by contact over the inner surfaces of the thighs. Treatment is based upon copious irrigations, absolute cleanliness and the removal of the warts by strong escharotics, the cautery, or knife. It is of interest to note that these growths, while common in young girls and women, are prone to grow to enormous proportions when associated with pregnancy.

Condylomata Lata.—These are whitened, plateaulike patches, with sharply elevated borders. They are manifestations of the secondary stage of syphilis and the spirochetes can be demonstrated in the subcutaneous tissue beneath them. After superficial irrigation and cleansing, calomel powder should be dusted over the skin and mucous membrane, at the same time vigorous systemic treatment is instituted.

Vulvitis and Vulvovaginitis.—Vulvitis and vulvovaginitis, or a generalized inflammation of the vulva and vagina are not common except in young girls, when they are usually due to gonorrhea, dirt, or abrasions from masturbation, and in elderly women where they nearly always depend upon non-specific infection coincident with the atrophy and diminished blood supply of that age. Scrupulous cleanliness secured by means of alkaline

douches, followed by thorough drying of the entire area and the application of Ung. acidi borici or Ung. zinci oxid, to the whole region is the ideal treatment. These applications may be made on strips of gauze held in place by a vulvar pad.

Smears of the discharges should always be taken and examined under the microscope before treatment is instituted. When the infection is proved to be of Neisserian origin, copious irrigations with potassium permanganate (1:5,000) are preferable (see page 163).

Bartholinitis.—The infections, particularly with the Neisserian diplococcus, are likely to involve the acini of Bartholin's gland. Abscesses of the structure result from an occlusion of the duct. Such abscesses are prone to recur unless every ramification of the gland is drained or removed. Wide incision, swabbing with pure phenol and neutralizing with alcohol frequently suffices, especially if drainage is favored and healing is allowed to take place from the depths of the incision. However, recurrences after incision and drainage are common, therefore it is probably better practice to extirpate the gland at once, pack the cavity with gauze, and dress at frequent intervals. Either of these procedures may be done under local anesthesia in any well-equipped office.

Atresia.—Atresia due to a fusion of the inflamed labia minora or an annular cicatrization of the introitus or vagina is not an uncommon sequel to vulvovaginitis. In a young girl the fusion of the labia may escape notice until time for menstruation to appear or even until marriage, when it prevents penetration and causes the patient to consult her physician. A simple incision is required to relieve the obstruction, but considerable care must be exercised to keep the incised lips separated by a dressing during the process of healing.

Varicosities of the Vulva.—These are commonly associated with pregnancy and may persist thereafter. Unless they cause annoyance or become thrombosed and infected they should be let alone.

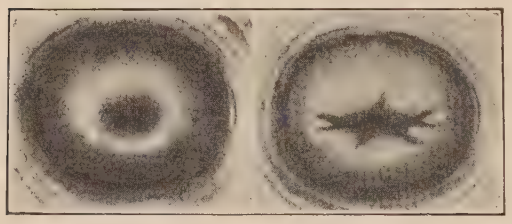
Tuberculosis of the Vulva.—This may occur at any age, is always secondary to a similar infection higher in the genital tract, and is particularly resistant to treatment. The first appearance of tuberculosis consists in numerous bronze-colored, firm nodules deep in the skin which may enlarge, coalesce and ulcerate, exuding a cheesy or mucoid substance. There are frequently secondary areolæ of a dusky red or brownish hue about the ulcers. Numerous burrowing sinuses extend from the ulcerated area and penetrate to unusual depths. The floor of the ulcer, when the pus is wiped away, leaves a bright red, granulating surface. There are no subjective symptoms such as pain, burning, or odorous discharge.

The area involved should be carefully cleaned, cauterized and excised. Depending on the area involved, the subsequent cicatrization may obstruct the vagina, urethra or anus. A plastic operation may be required to relieve this complication.

Chancre of the Vulva.—This is rarely seen by reason of the fact that it is a transient lesion and easily hidden in the folds of the labia or fourchet. (See Fig. 4.) Then, too, the syphilitic infection may enter upon a site already affected by a different lesion and for this reason escape recognition on cursory inspection. For instance, infection by the Spirochæta pallida and Ducrey's bacillus may be simultaneous or superimposed and, unless a darkfield smear is done, the presence of treponema may not be suspected. Extirpation of the primary sore is not effective, and may lead to a false sense of security in treatment. Intensive constitutional treatment should be begun as soon as the diagnosis is made, while the primary lesion may be cleansed and dusted with calomel.

DISEASES OF THE CERVIX

Exposure of the cervix through a speculum is a simple procedure in the married woman and should be included in all routine physical examinations of such patients. By means of bimanual palpation, atrophy or hypertrophy of the cervix, impairment of its normally smooth surface, and the patency of the internal os can be made out, but only by direct inspection can the degree of infection, the extent of the hypertrophy and the presence of ulceration or erosion be determined.



A B

Fig. 7.—A. The Normal Nulliparous Cervix. B. The Normal Parous Cervix (Williams, "Obstetrics").

Normally the nulliparous cervix projects into the vaginal vault, is smooth and regular and has a firm consistency. The direction in which the cervix points aids in a diagnosis of position of the uterus. The character of the cervical secretion is of importance from a diagnostic viewpoint (see Leukorrhea), and the degree of descensus of the pelvic organs is measured by the relation of the cervix to the introitus. Infections of the genital tract nearly always manifest themselves by changes in the cervix, where they soon become chronic and persistent. We recognize an acute endocervicitis which is commonly gonorrheal and a chronic endocervicitis which requires more detailed study and patience in treatment. In regard to the diagnostic value of the appearance and position of the cervix, neoplasms and inflammatory masses in the pelvis may push the cervix down to the perineum and outlet. Or in another case, a relaxation of the normal supports may allow the uterus to fall until the cervix reaches that level. Furthermore, minor degrees of laceration of

the cervix commonly distinguish a parous from a nulliparous os (see Fig. 7). Such lacerations, especially lateral ones, usually follow improper obstetrical procedures. Manual dilatation and the application of forceps before the cervix is fully dilated are the commonest causes of severe bilateral lacerations. Following these injuries the cervical lips become everted (ectropion, Fig. 8), and an irritation of the mucous membrane results. This irritation may lead to ulceration or erosion. The latter term is applied when the normal stratified squamous epithelium of the cervix has been replaced by the single high columnar layer of cells of the cervical canal.

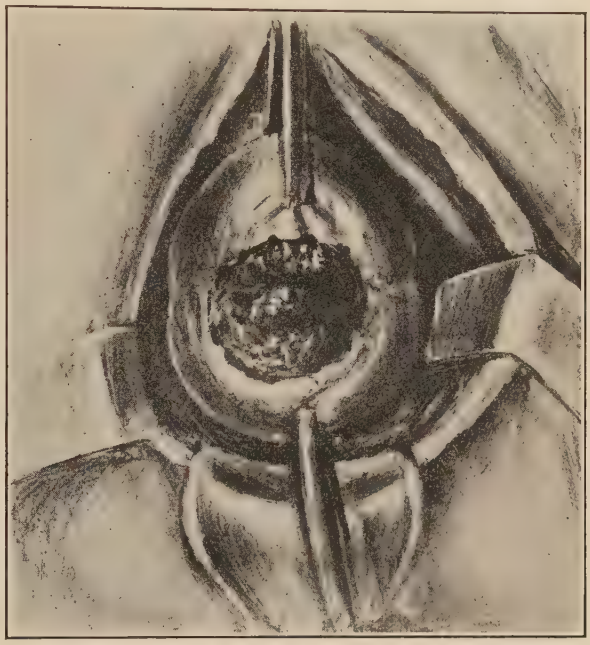


Fig. 8.—Hypertrophy, Eversion and Erosion of the Cervix, Strongly Resembling Neoplasm.

In cases of hypertrophy and elongation of the cervix and in second and third-degree prolapse, the cervix may protrude through the introitus and the exposed stratified squamous epithelium may ulcerate, due to chafing or trophic changes. Such ulcers rarely undergo malignant change, but spread and cause burning and bleeding.

The neoplasms of the cervix are the adenomata, commonly spoken of as "polyps" (Fig. 9), submucous myomata, which become pedicled and extrude through the external os, and carcinomata. The last may be of the adenomatous type or the squamous-cell type. In these three conditions, benign polypi, myomata and cancer, bleeding is the commonest symptom, and, while varying in degree, commonly follows coitus, douching or other slight trauma.

Atrophy.—Coincident with the menopause a physiological atrophy of the female generative organs occurs which is directly due to a diminished blood supply. The portio of the cervix projecting into the vagina gradually decreases in size until the external os is "flush with the vaginal vault." This is associated with an annular constriction of the vaginal

lumen at its upper end, so that the finger can scarcely reach the cervix and palpate the uterine body above. No treatment is necessary.

Hypertrophy.—Hypertrophy is always associated with infection, laceration and congestion of the cervix. It varies in degree with the chronicity and extent of the etiological factors. Applications to reduce the infection and strong hydroscopic tampons of glycerin, together with support of the displacement, if any exists, will reduce the size of the cervix. If unassociated with pelvic infection, and if the patient is still capable of childbearing, palliative medical measures such as have been suggested will be all that is necessary. Amputation affords permanent relief, in conjunction with other radical surgical procedures such as suspension and outlet repair.

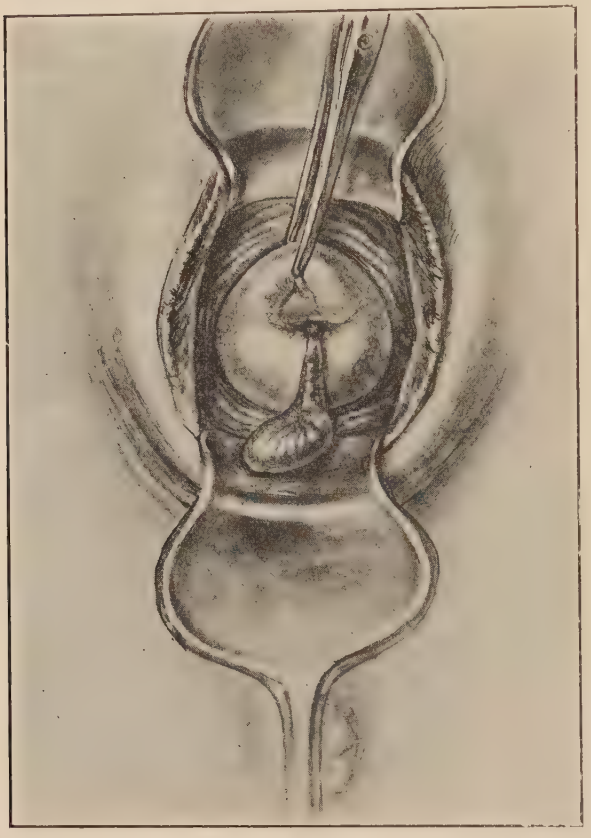


Fig. 9.—Cervical Adenoma (Polyp).

Atresia. — Occlusion of the cervical canal may be congenital, resulting in a hematometra after puberty, or acquired, due to too severe instrumentation or medication. Simple dilatation is not sufficient for its relief, but plastic operations of the Dudley or Pozzi type are recommended.

Occasionally in elderly women a collection of pus forms in the uterus behind a closed internal os (pyometra). This condition usually produces some local irritation and is inclined to recur. It is often associated with adenocarcinoma of the body of the uterus. Such cases should be forcibly dilated, the pus drained out, the cavity carefully explored for malignant changes and, following the curettage, the entire cavity should be swabbed with tincture of iodin (2½ to 5 per cent). The applications of iodin may be repeated at frequent intervals in the physician's office, and the canal kept open for free drainage.

Chronic Endocervicitis, Hypertrophy of the Cervix and Erosion.—The evidences of infection of the cervix involve all degrees and combinations of the three pictures. How much in the way of subjective symptoms is caused by the condition depends on the sensitivity of the patient to leukorrheal discharges and to the degree of her physical activity. Occasionally prolongation of the periods accompanies the condition, but in

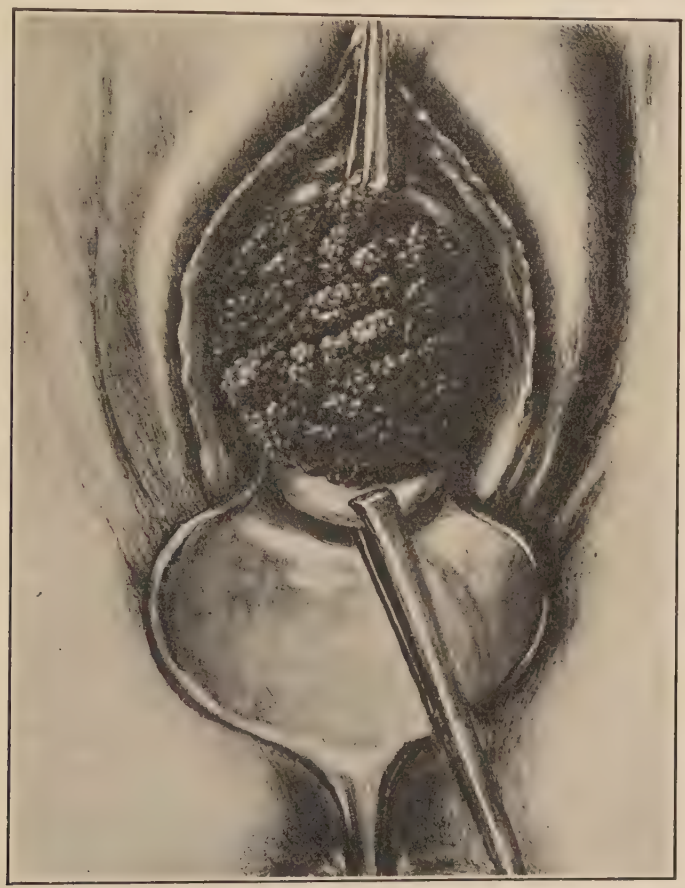


FIG. 10.—EXTENSIVE CAULIFLOWERLIKE ADENO-CARCINOMA OF THE CERVIX (Inoperable).

those instances there is usually an associated pelvic inflammatory disease. In the more acute stages of infection spotting of blood may occur between the periods.

When the condition is brought to the physician's attention two common errors are committed. On the one hand the condition may be ignored, while on the other hand too much temporizing therapy may be attempted. In the latter case the patient is easily led into a psychosis or hypochondriasis, receives only temporary relief from treatment and sometimes be-

comes a chronic invalid. Some of our English confrères devised a "rule of thumb" for the proper conduct of these cases which involves the successive employment of the three agents, "carbolic, cautery and cut."

The local applications of pure phenol, neutralized with alcohol, silver nitrate (15 per cent) or mercurochrome (1 per cent) should be followed by copious irrigations at bedtime of some alkaline and astringent douche. Twice a week in cases showing congestion and hypertrophy, a glycerin tampon may be introduced to encourage drainage and depletion. After from three to four weeks with only temporary relief and no visible change in the appearance of the lesions, the actual cautery should be used and the cervix seared radially. During the period of possible childbearing care should be taken not to burn the cervix and permanently limit dilatation. If these measures are not effective, resort must be had to plastic operations. Annular amputations must not be performed unless the patient is sterilized or is past the period of childbearing.

DISPLACEMENTS OF THE UTERUS

The uterus may be held in abnormal position by entirely extraneous forces, such as tumors or inflammatory conditions in the pelvis, or it may fall into malposition by reason of intrinsic disease. These malpositions may be present at birth or may be acquired at any time thereafter. Thorough history-taking will frequently suggest the character of the trouble through pressure symptoms on bladder or rectum, together with uterine backache. There may be some alteration in quantity and some pain associated with menstruation. Careful digital examination will demonstrate the removal of the normal landmarks to their new positions.

Malpositions of the Uterus.—These include forward, backward and lateral displacements. The uterus may bend upon itself at the junction of cervix and corpus (flexion) or turn its long axis through an anteroposterior arc hinged at the broad ligament attachment (version). The organ normally lies in anteversion with the fundus on the bladder and the cervix pointing posteriorly toward the rectum and the sacrum. This term, anteversion, therefore, should not be used to describe a pathological position.

Anteflexion.—The sharp forward angulation of the uterus is commonly associated with dysmenorrhea and sterility. There is occasionally an accompanying hypoplasia. When this symptom complex is present it is probably unwise to devote too much effort to palliative office treatment. Drastic dilatation is preferable to the "plastic" operations. The dilatation should be accomplished slowly by some constant pressure (as with the Hirst metranoikter) rather than abruptly. Both rapid dilatation and plastic operations leave scars which later may impede labor.

Retrodisplacements.—Backward displacements are much more frequently observed and are of such importance as to demand immediate attention. Many temporary and minor measures relieve a large proportion of these malpositions. The field of conservative technic is widened to such a degree that medical treatment should always be attempted before resorting to laparotomy. The possible cause, degree of associated inflammatory disease, and anatomical abnormality should be determined in each case and appropriate treatment instituted before resorting to manipulations to correct the backward displacement.

Congenital Retroversion.—This is nearly always associated with hypoplasia and may be combined with a retrocession (see Graves' "Gynecology"). The condition may be accidentally discovered and in that case should be made note of, possibly mentioned to some responsible member of the family, but never emphasized to the patient. Further, it is the opinion of a majority of gynecologists that uncomplicated retroversion in the nulliparous woman should not be treated unless symptom-bearing.

If, however, the condition is accompanied by a severe dysmenorrhea and backache, the patient voluntarily limits her activities by reason of these symptoms, and, if simple treatment of a general asthenic state does not afford relief, operation may not be postponed.

Moderate degrees of hypoplasia associated with congenital retroversion occasionally respond to ovarian extract and pituitary extract when prescribed over a long space of time. A large group of these cases only need sexual excitement or impregnation to cure the condition. Unfortunately the patients are frequently acquainted with the fact that the retroversion exists, some slight trauma has been emphasized by the parent or physician as having an etiological significance, and all her symptoms are ascribed to the displacement.

Any delay in examination of the patient to eliminate ureteral stricture, constipation or other cause of her symptoms is not advisable. Too frequent or protracted local treatments lead frequently to a "neurosis of pelvic overvaluation." Unless the prospect of an early marriage is imminent, the displacement had best be corrected by operation.

Acquired Retrodisplacements of the Uterus.—Acquired retroversion may be traumatic in origin and occur at any age, but is of particular importance in early adult life. Occupational and accidental injuries have brought the condition into notice through medicolegal channels and have imposed a grave responsibility upon the physician. Retroversion may exist prior to the time of injury and have been symptomless, while an acute retroversion directly due to the injury is, like volvulus or intra-abdominal hernia, of sudden onset and incapacitating. The symptoms are striking and include pain of the uterine type in the sacral region, occasionally radiating along the course of the sciatic nerve, nausea and faintness on an effort to stand and a typical posture and gait assumed. The

shoulders stoop, the head and body are bent forward from the waist and the foot is put down gently. Defecation is painful and uterine hemorrhage may occur.

The uterus should at once be replaced manually under anesthesia and the patient confined to bed for a week or more. Having replaced the uterus, it may be held in position by packing the vagina with tampons (Fig. 11). The latter should be replaced at frequent intervals especially upon first allowing the patient to get out of bed.

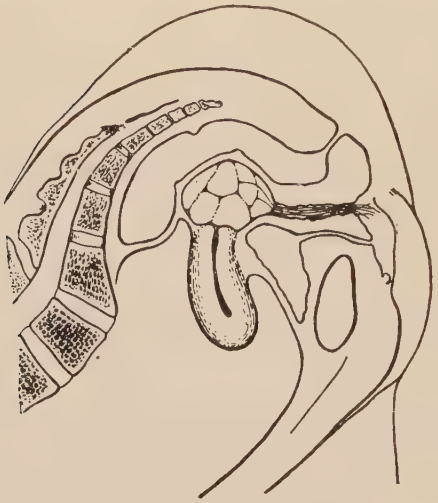


Fig. 11.—Diagram of the Sagittal Section of a Patient in the Knee-Chest Posture. The vagina is packed with tampons to maintain the uterus in normal position. (From Anspach "Gynecology," J. B. Lippincott Co., 1922.)

The majority of acquired retroversions, however, are due to more chronic processes. Infections of the genital tract in the nullipara and subinvolution following childbirth are the most frequent causes.

Localized peritoneal irritation or infection of the tubes drags the fundus posteriorly, and creates considerable distress. This type of retroversion cannot be overcome in its acute stage; nor if the uterus becomes adherent in the culdesac can the condition be relieved by external manipulations. Frequently the congestion and the minor adhesions can be relieved by depleting hygroscopic tamponade and douching, so that when first examined an immovable uterus may later be rendered amenable to manual reposition. When so replaced, the uterus should be held in position by a pessary or pack, until all chance of recurrence is overcome.

When the condition follows abortion, premature delivery or term labor, subinvolution and low-grade puerperal infections are etiological factors. If the patient is allowed out of bed before the uterus is well involuted, or if she has maintained the dorsal position too long following childbirth, the large and soft uterus falls posteriorly. As soon as this occurs and the bulk of the organ is past the fulcrum on which it normally rests, retroversion and retroflexion at once supervene. Unusual distention of the sigmoid may predispose to this condition. An old puerperal infection increases its likelihood. Upon arising, the patient notices a backache, headache and prolongation of the bright lochia. Retrodisplacements from these causes are capable of correction manually, and this procedure should

be done before discharge, or else it becomes chronic and is overcome with greater difficulty after the lapse of time. When the retroversion is due to an overstretching of the uterine supports, little permanent benefit may be derived from the use of pessaries, but palliation may be secured and temporary relief offered. If some constitutional contra-indication to operation exists, a well-fitting pessary may be left in place and changed each month.

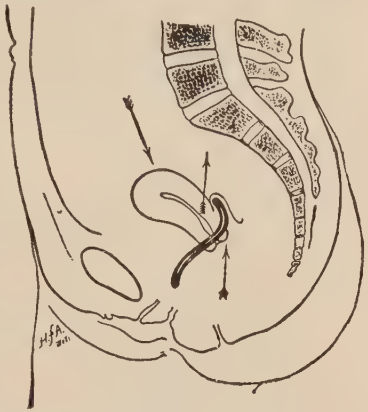


Fig. 12.—Sagittal Section of the Body with a Pessary in Place, Showing the Physical Forces Maintaining the Position of the Uterus. (From Anspach "Gynecology," J. B. Lippincott Co., 1922.)

Manual Reposition.—Manual reposition of the uterus is effective only when the fundus is free and the uterine supports remain normal. With the patient in the lithotomy position, the cervix is grasped by a double tenaculum and drawn down in the long axis of the vagina. The forefinger of the free hand of the operator is inserted in the rectum and the fundus pushed forward. With that finger as a guide, the tenaculum pushes the cervix posteriorly and upward until the fundus can be grasped through the abdominal wall. The abdominal hand then pushes the fundus down under the symphysis and maintains the normal anteposition thus secured (Fig. 13).

STANDARD METHODS OF TREATMENT

To devote a chapter to methods of treatment which are generally applicable implies that a common etiological factor exists for many gynecological conditions. I call this common complication "asthenia," and interpret the term to include deficiency in hygiene, nutrition, development, or emotional stability. The strongest evidence in support of this contention is the frequent coincidence between a general asthenic state and gynecological disease. It is true that, in many instances, a vicious circle exists wherein it is impossible to determine whether the pelvic disorder is the cause of the asthenia or coincident with it. Nevertheless, adequate treatment of gynecological conditions should include attention to general hygiene and physical development. Moreover, the female child of the preschool age must be watched so that prophylactic treatment may be instituted if necessary.

During childhood a girl should be equally as active as her brother. Anemia, undernourishment and constitutional diseases resulting in apathy

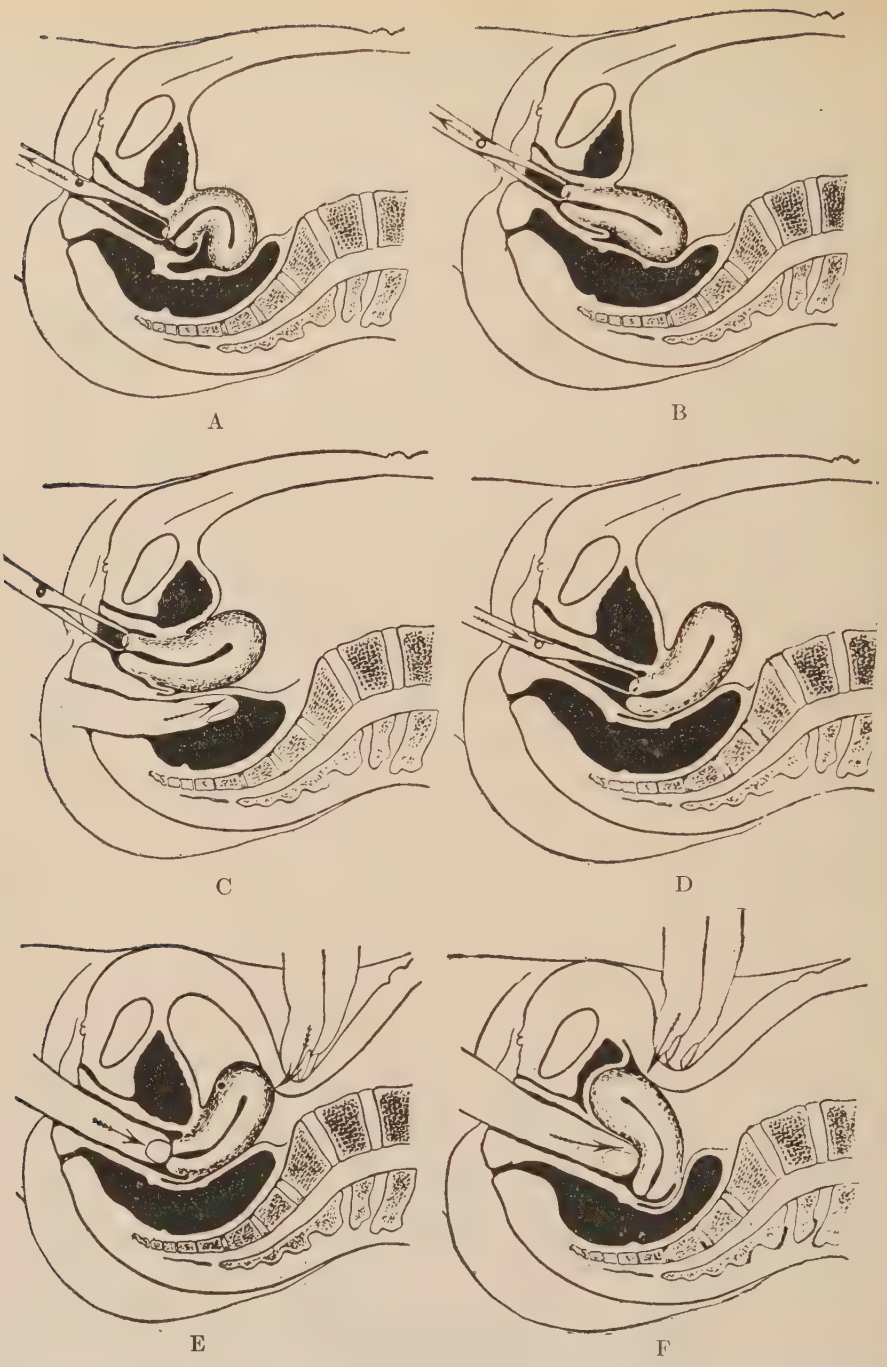


FIG 13.—MANUAL REPOSITION OF THE RETROVERTED UTERUS. (From Anspach "Gynecology," J. B. Lippincott Co., 1922.)

A. The anterior lip of the cervix grasped in a tenaculum.
B. The uterus drawn down in the long axis of the vagina.
C. A forefinger in the rectum pushes the fundus upward.
D. By inward pressure on the tenaculum the uterus can be brought forward until:
E. The fundus can be grasped through the abdominal wall and,
F. Forced into normal anteversion.

should be guarded against and corrected at once. Rachitic malformations, which later cause bad posture and dystocia, have their origin, of course, in infancy and childhood. Fusion of the vulva and other permanent injuries may result from vulvovaginitis, which in turn may be due to gonorrhea or to a pyogenic infection, resulting from lack of cleanliness, masturbation, and similar causes.

Coincident with puberty, which occurs earlier in the girl, numerous psychic differentiations appear, as well as the emphasis of secondary sexual characteristics of a structural nature. Some limitation of physical activity and slight indisposition may occur at the time of the onset of the menstrual periods, but provided there is no constitutional disease present which contra-indicates exercise, disinclination for physical activity should not be encouraged. Pronounced permanent damage at this time arises from improper hygiene, faulty habits of dress, bad posture, lack of outdoor exercise, bad diet, ill-chosen occupations, mental worry and, occasionally, inherited physical or mental weakness. In a healthy woman the onset of menstruation, the menstrual period and the menopause should be as physiologic and as free from distressing symptoms as digestion or respiration. At these critical seasons, exposure to cold, tub baths and unusual exercise should be avoided. Nothing should be said or done to direct the attention of the patient to a possible pelvic origin for her complaints.

Hydrotherapy.—To improve the general condition certain widely applicable methods of treatment may be mentioned, such as bathing, exercises and constitutional drug therapy. Body bathing, as well as specific hydrotherapeutic measures, are essential factors in stimulating the general hygiene of the patient, and are of specific value for local treatment. Besides stimulating elimination, baths allay irritation and deplete the congestion prior to the onset of the period. Such bathing must be moderated during prolonged illnesses, particularly those due to specific or puerperal infection. Tub bathing is contra-indicated during the menstrual periods, at or near the termination of gestation and during the puerperium. At these times, as well as during the course of prolonged infectious diseases, sponge baths and occasional shower baths are permissible. If a warm bath produces relaxation and drowsiness, it should be prescribed at bedtime, although, provided undue exposure does not immediately follow the bath, it is permissible at any time of day. One of the most effective means of combating congestion due to pelvic inflammation is the sitz bath. Directions as to the temperature of the water, and the addition of sea-salt or magnesium sulphate must be given specifically. Cold baths, needle baths, salt slap sheets and similar stimulating measures are particularly useful to improve the body tone and to hasten convalescence after a prolonged illness or an operation.

Physiotherapy.—Physiotherapy is an important adjunct in the treatment of the generally low-toned, weak and flaccid musculature, and assists in the treatment of certain gynecological conditions. The simplest example is the use of the knee-chest position to aid in the reposition of a retroverted uterus. In addition to such adjuncts to therapeusis, specially devised exercises and supports rapidly improve such conditions as toxic arthritis of the spine, visceroptosis and postural defects.

In either instance there are three factors involved: (*a*) the posture, as exemplified by the normal lordotic curve of the dorsolumbar spine; (*b*) the ventral abdominal musculature; and (*c*) the development of sufficient subperitoneal and perirenal fat. In the first instance, not only must corrective exercises be employed to teach the patient how to stand and to stimulate the flabby musculature to a better tissue tone, but some adequate support must be devised to aid permanently in maintaining this position. Therefore, the psysiotherapeutist should be interested not only in the problem of active correction but also in the question of passive orthopedic support.

Dickinson described the faulty postures as of the kangaroo or of the gorilla type. In either case, pelvic inclination and the line of support deviates from the normal. The result is static backache and numerous vague abdominal pains, coupled with an obvious loss of energy and tissue tone. These patients are blasé, always tired, even lethargic. They lack the initiative voluntarily to take "setting-up" exercises. Moreover, such exercises are probably too drastic for the novice. To begin with, a brisk general massage twice a week, followed by a one-hour rest period, should be prescribed. In the intervals between massage treatments simple breathing exercises are ordered to be repeated night and morning. These should be done with the body unrestricted by clothing. After three weeks of rest periods, breathing exercises and massage, patients begin to gain, and at that time a cold morning sponge, followed by more active exercises, should be required. At first these should be taken under supervision, but later done voluntarily. Suitable exercises are detailed by Cronne, Müller, and Dickinson and Truslow.

Following sufficient improvement, patients should be urged to indulge in sea bathing, tennis and similar out-of-door activities. The more sedate may participate in less violent out-of-door sports.

Constitutional Remedies.—In the asthenic state, in secondary anemias and after operations, dietary and drug therapy are necessary to improve the patient's condition. Tonics such as nux vomica, in conjunction with a forced diet of cream and green vegetables, are serviceable. Fresh air and sunshine are essential to a rapid cure. For the past few years the practice of putting profoundly infected and debilitated patients out-of-doors during convalescence has proved a successful adjunct to other treatment. All these procedures are useful while the patient is still combating an in-

fection or recuperating in bed. Provided no thrombophlebitis exists, passive motion and general massage may be permitted as soon as the temperature has been normal for seven days.

Attention has already been directed to the use of iron and arsenic for secondary anemias, as well as to the dietetic and drug therapy which promote elimination by bowel.

The forced ingestion of fluids is of the utmost benefit in combating infection and promoting elimination; therefore the fluid intake and output should be encouraged and recorded in such conditions.

The limited number of specific drug remedies at our command and the exploitation of the older pharmacologic agents known as "alteratives," as well as the doubtful "uterine tonics," led to too frequent prescribing without an adequate examination and an accurate diagnosis. To a more marked degree the same objection obtained regarding patent medicines; and their indiscriminate recommendation to the laity led to the failure to recognize serious conditions in their curable stages. Much less frequent but none the less serious was the risk of the formation of an alcohol or a narcotic habit which such remedies induced.

Of primary importance, then, is the establishment of a diagnosis, following which specific therapy may be applied where available. Otherwise, constitutional support must be fostered, symptomatic relief afforded, and natural forces encouraged, bearing in mind that prolonged administration of various remedies by mouth makes the stomach irritable and intolerant, and frequently undoes real good by limiting the amount of nourishment the patient can retain.

SPECIAL METHODS OF TREATMENT

Douching.—Vaginal douches have three aims: (1) antisepsis; (2) the removal of viscid mucoid and mucopurulent secretion; and (3) by their warmth to induce a temporary hyperemia, which allays inflammation and promotes a resorption of the induration in adjacent organs. For these purposes the constituents of the douche may vary, but certain conditions are requisite. The solutions should be heated to at least 110° F. in the can and should be taken while the patient is lying down in a bathtub or with a douche pan under the slightly elevated hips. The fluid should run in by gravity from a 2-foot elevation.

The most effective antiseptic douche is a 1:10,000 solution of potassium permanganate. This oxidizing agent is superior to all others, but has the disadvantage of staining everything with which it comes in contact. Bichlorid of mercury is toxic, dangerous to have about the house and, since its coats the walls of the vagina with an albuminate which prevents penetration, is a poor antiseptic. The cresol solutions (proprietary lysol

is the best example) are valuable as antiseptics, even in a 0.5 per cent solution, but they irritate and burn inflamed or sensitive areas. Both bichlorid and lysol are poisonous and are too frequently and indiscriminately employed by the laity. Furthermore, in too strong concentration they may cause a sloughing of the vaginal mucosa.

The astringent douche is best represented by the alkalis, such as borax, bicarbonate of soda, alum and zinc sulphate. In judicious combination of antiseptic properties, effectiveness and pleasing qualities, nothing supercedes:

℞	Acidi Borici	℥vi
	Pulveris alumi exsiccat.	℥iii
	Phenolis	℥i
	Olei gaultheriæ Olei menthae piperitæ	āā gtts. iv

Misce et signa: Douche Powder. Teaspoonful in 2 quarts hot water.

As a simple cleansing or therapeutic douche without strong antiseptic qualities, nothing more than borax or baking soda (℥ss to the quart) is required. The alkali is sufficient to remove the viscid mucoid discharge.

As a contraceptive measure the douche has a vogue, but it is certainly not reliable for this purpose and, because too cold water may be used or too much pressure applied, it has real dangers. Douches are, of course, contra-indicated during pregnancy, menstruation and the puerperium, for, while the cervical canal is open, organisms may be driven into the uterus and tubes.

Fig. 14.—Menge Pessary.

Pessaries. — Pessaries are fashioned from vulcanized rubber, soft rubber and other malleable substances. The type employed depends upon the character of the lesion and the result expected. They are usually in the form of some modification of a ring or a disc. The most useful instrument for the treatment of reducible retroversion is the Smith, or Smith-Hodge. This pessary is oval, with the alternate poles oppositely curved. For most cases of prolapse a ring pessary, held in place by the lateral attachments of the vagina, together with the rami of the pubes, is preferable. These ring pessaries have been variously modified to meet special condi-

tions. First, the disc pessary, which is particularly useful for elderly patients who cannot withstand plastic operation but who are not expected to perform very heavy duties, is the Menge modification of the ring pessary (Fig. 14). This instrument is made in various sizes, gauged by

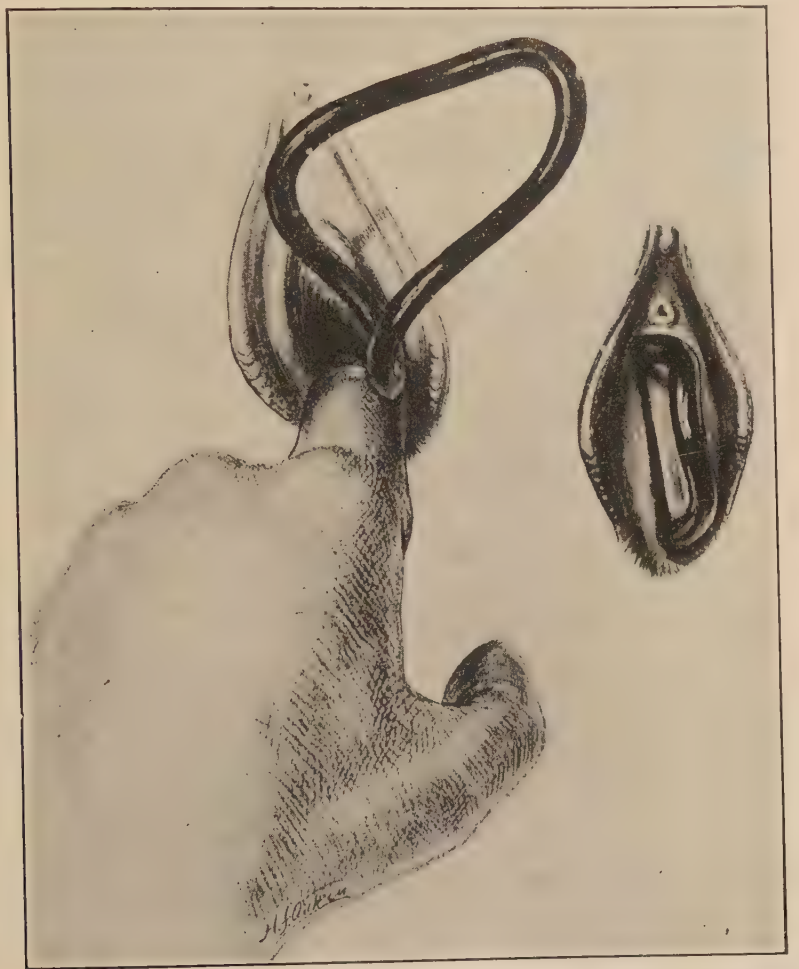


FIG. 15.—THE PROPER METHOD OF INSERTING A PESSARY. (From Anspach "Gynecology," J. B. Lippincott Co., 1922.)

the diameter of the ring (4 to 10 cm.). The ring lies transversely to the long axis of the vagina, and is retained in position by the detachable post which acts as a rudder or guide.

In order to be effective, a pessary must fit accurately, and must be removed at frequent intervals for the purpose of cleansing the vagina. The slightest pressure from a badly fitting pessary will cause excoriation and ulceration. In the presence of chronic infectious conditions of the

uterine adnexa, the bladder or vagina, the use of the pessary is contraindicated. A pessary should be removed once a month in order to prevent irritation of the mucous membrane, and may be replaced after an interval of four or five days.

To insert a ring the patient is put in the lithotomy position on the examining table and the outlet and vulva well lubricated with a simple ointment or oil. The size of the canal and the nature of the support desired will determine the type of pessary that is most serviceable (see Displacements, page 156). The pessary should be inserted obliquely in its narrowest diameter, care being taken to avoid the region of the clitoris and urethra. The more gently and carefully the first attempts are made, the more coöperation the patient will afford. The forefinger of the free hand may be used to depress the floor of the vagina and the fourchet, which are capable of sustaining more distention than the tissues between the rami of the pubis and the symphysis. When the entire instrument is within the introitus (and the largest pessary should be used which can be inserted without actual pain), it should be turned from an oblique to a transverse position. By inserting the finger in the vagina until the uppermost bar of the pessary is met, the latter can be slipped behind the cervix by gentle depression toward the sacrum, and upward pressure toward the promontory. The walls of the vagina in either lateral vault should not be put upon a tension by the pessary, and the upper cross-bar should support but not press too snugly against the cervix lest areas of necrosis and ulceration result. These accidents can be avoided by removing the pessary, holding it in very hot water for a few moments and then molding the curves to meet the needs of the individual case.

Tampons.—Medicated tampons are used to allay irritation and to disinfect or deplete the area to which they are applied. They are also useful temporarily to sustain the uterus in position. The ideal tampon is made of lamb's wool, which does not "shrink and mat" upon becoming moist. To the tampon is attached a stout linen thread, sufficiently long to facilitate its removal after a specified interval. In making applications to the vagina, a cylindrical or oblong tampon is medicated and inserted endwise through a bivalve speculum. In treating the cervix, a square is "cupped" in one hand, the medication poured into the hollow formed, and the cup inverted over the cervix with a dressing forceps.

Local Applications.—Infections of the urethra, vulva, vagina, or cervix require local applications. The medicaments employed are usually painted on the affected area by an applicator wrapped with cotton or by a camel's hair brush. The most useful solution is strong silver nitrate (10 to 15 per cent), carbolic acid (1 : 40 to 1 : 20) later neutralized by alcohol; tincture of iodin (7 per cent to 2½ per cent) and ichthyol, pure or diluted with glycerin. The application of any of these strong solutions by pouring them through a Ferguson speculum causes the patient some

pain from burning, but prompt and copious irrigation with warm salt solution relieves the distress.

To effectively treat an infection of Skene's or of Bartholin's glands a Luer syringe with a blunt hypodermic needle is essential. Through the latter, inserted into the reddened ducts, weak solutions of silver nitrate may be injected directly into the gland.

To allay mild pruritus official zinc oxid ointment may be applied to strips of gauze cut 1 inch wide by 6 inches long, and laid side by side over the irregularities of the surface of vagina and vulva. The addition of 10 minims of phenol to each ounce of zinc oxid ointment hastens the desired result.

Instillations into the cervical canal may be made by the use of a Dakin's syringe, which is easily cleaned and is less expensive than the especially designed Braun's syringe. The favorite solutions are tincture of iodin (half strength) for the more acute, and 1 per cent mercurochrome for the chronic cases. Occasionally it is necessary to steady the cervix with a sterile double tenaculum. Before instrumentation is carried out the cervix should be exposed by means of a bivalve speculum and its external surface swabbed with iodin. With these precautions the treatment is not likely to spread the infection. However, a certain number of patients may suffer severely with uterine colic requiring rest, a hot-water bottle to the lower abdomen, and occasionally morphia, gr. 1/6, and atropin sulphate, gr. 1/150, hypodermically.

Irrigations are practicable for the urethra, the bladder and, under certain circumstances, for the uterus. This procedure must be done with the greatest care and under strict aseptic precautions.

Urethral irrigations are used to relieve urethritis, which is caused by gonorrhea in most cases, but which may be due to non-specific pyogenic infection in unusual instances. The latter occur more commonly in elderly patients with relaxed pelvic floor, cystocele and prolapse. Sterile solutions of boric acid (10 gr. to the ounce) or potassium permanganate (1: 5,000) at body temperature, are allowed to run into the urethra through a two-way catheter. The latter instrument may be of glass, which is readily cleansed, but which will break easily if the patient changes her position suddenly because of pain; of rubber, which is expensive, not durable, and very difficult to clean; or of silver, which can be procured of finer caliber than either of the aforementioned materials. It is customary to irrigate the meatus first, the anterior urethra second, and to force a very small amount of the fluid into the deeper urethra last, lest the infection be driven into the bladder. At the conclusion of each urethral irrigation, it is wise to introduce the catheter into the bladder and wash it out once, thereby removing any infective material from the cavity.

Bladder irrigations are performed for the relief of cystitis or spastic contracture. Boric acid solution (10 gr. to the ounce) is best and may be

introduced through a two-way catheter or a soft rubber catheter to which a funnel is attached. At first the solution is permitted to run in and out freely. This is followed by alternate filling and emptying of the viscus. Careful attention must be given to the rate of flow and the amount retained. Pain and a strong desire to urinate are experienced at first when a small quantity of the fluid is injected; later, as the infection subsides, the bladder becomes more tolerant and improvement can, in this way, be noted objectively. Each irrigation should be followed by the instillation of 10 c.c. of a colloidal silver salt (argyrol, 25 per cent, or mercurochrome, 1 per cent freshly made miscible solution), which is allowed to remain.

Uterine irrigations should not be practiced in the physician's office, but may be required once, during the course of a puerperal or a postabortal infection, to remove saprophytes and necrotic decidua. Shortly after completion of an abortion or delivery of a term child, the patient's temperature may rise above the line of morbidity (100.4° F.) and remain at or recur to that degree on the following day. This usually bespeaks a ulterine infection, especially if the uterus is soft and the adnexa are tender upon pressure. Ice-caps should be applied to the lower abdomen, the bowel emptied and the patient induced to void, or catheterized if she is not able to empty the bladder voluntarily. If the temperature remains elevated for twenty-four hours the physician may irrigate the uterus. Preliminary curettage is contra-indicated, for such a procedure serves merely to spread the infection by breaking down the first protective leukocytic wall. Preparatory to the irrigation, the patient is placed in the dorsal position, the vulva cleansed and surrounded by sterile dressings. A speculum is introduced and the anterior lip of the cervix caught with a double tenaculum, and the cervix and vault of the vagina are swabbed with half strength tincture of iodin. A Bozeman two-way uterine douche nozzle is introduced directly into the cervix, without touching the sides of the vagina or the speculum. To this is attached the tubing from the irrigating bag. The latter should be hung not more than 2 feet above the level of the patient's hips and the solution should be allowed to flow in and out freely without inducing pressure.

The solutions best adapted to uterine irrigations are sterile water, salt solution, weak boric acid (gr. x to the ounce) and potassium permanganate (1:5,000), maintained at a temperature of 115° F in the bag or can.

The use of vaginal douches within two weeks following delivery should be prohibited. Such a procedure is dangerous while the os is open, and bacteria from the vagina may be washed directly into the uterus.

X-ray and Radium.—Considerable attention has been directed lately to the action of gamma rays of radiant energy on body tissues and tumors. This physical agent, about which little is known, is found in nature emanating from minerals, and may be generated by the Roentgen ray machine. The rays penetrate the body with an effect diminishing inversely

as the square of the distance from the surface. They may injure all tissues but apparently cause a necrosis of tumor cells and certain highly specialized epithelium before they affect the somatic connective tissue elements. Because of this selective action on tumors radium emanations and X-rays are extensively employed in gynecology. By reason of its flexibility of application radium is more frequently used within and about the uterus, while areas beyond that region are more readily affected by the Roentgen ray. To advise treatment intelligently the physician should appreciate the limitations of each form of therapy. Surgery and radiation are not alteratives but adjuvants. The one cannot replace the other, and the results attained conjointly still remain unsatisfactory, if not afforded in the early stages of the disease.

DISEASES OF INTERNAL GENITALIA

Carcinoma of the Cervix and of the Uterus.—Depending upon the extension of the growth beyond the cervix, with consequent lessening in the mobility of the uterus, cases of cervical cancer are divided into the operable, border-line and inoperable groups. Owing to the nation-wide propaganda for early consultation when cancer is suspected, the cases in the first class may become relatively more numerous, but at present an early growth is an accidental finding. In the early stage of the disease there is no limitation of motion of the uterus and no palpable extension beyond the limits of that organ. Under these circumstances, a radical panhysterectomy is indicated, although a more favorable result is obtained if a preliminary radiation of 2,000 mg. hours is given at least from four to five days and not more than one month prior to operation. So treated, this type of case offers the most favorable prognosis, although insufficient time has elapsed adequately to estimate the added benefit of radium and X-ray.

Radiation has a field of usefulness in bringing a larger proportion of border-line cases within the range of cure. Extensions of the growth beyond the confines of the cervix are associated with wide lymphatic dissemination, preventing complete surgical extirpation. Except in those cases which involve the anterior vaginal wall and uterovesical septum, radium may be used with benefit. The application of radium along the vesicovaginal partition frequently causes a fistula to form or else the dose is insufficient to destroy the carcinoma cells. Where a large, cauliflowerlike cancer (Fig. 10) projects through the cervix into the vaginal vault, this mass should be extirpated with the cautery-knife or slow heat by the Percy method—before the radium is applied. At times the removal of such a proliferation and the preliminary radiation improves the mobility of the uterus and leaves no palpable trace of malignancy. There is then a great temptation to remove the uterus and adnexa. However, it is best

to let the uterus alone and to augment the 2,000 mg. hours administered within the uterus by a further radiation of 1,000 mg. hours in each lateral fornix. Protection to the bladder on one side and to the rectum on the other can be attained most satisfactorily by packing gauze around the radium container until the vagina is distended to its capacity.

Recurrences after operation respond to radium fairly well, but the ultimate outcome in such cases is not bright. Moreover, radiated but unoperated cases frequently show recurrences after a six-month interval of apparent freedom. As a matter of principle, every effort to treat all affected areas must be made in the first series of exposures (all within one month) rather than to attempt extensive distribution of the radiation over a longer space of time. It is doubtful if when this treatment is unsuccessful much more good can be accomplished by later radiation. Nevertheless, continued treatment of reappearances should be advocated on the chance that cure may be effected or palliative results obtained.

To a physician who has formerly attended many patients through the last stages of uterine carcinoma with the distressing picture of fistulæ, foul and bloody discharges, pain and slow wasting, the palliative effects of radium are remarkable. To the inoperable cases, which still represent by far the largest percentage of cancer cases coming to the specialist and the larger clinics, radium and X-ray are of marked benefit. It is true that after an interval of six months' freedom from pain, bleeding and discharge, there may develop extensions along the uterosacral ligaments, signs of partial obstruction, involvement of the nerve roots and considerable pain, but this can be alleviated and the foul discharges, hemorrhages and fistulæ rarely reappear. Consequently, radiation may be offered to prolong life and palliate symptoms in the inoperable cases.

Epitheliomata arising from the portio of the cervix are slower in growth and more protracted in their clinical course than adenocarcinoma and consequently are more favorable for treatment by both surgery and radium.

Carcinoma of the Body of the Uterus.—In good surgical clinics the primary and secondary mortality from carcinoma of the body of the uterus is so low that such patients should be subjected to operation as soon as the diagnosis is made. In the advanced inoperable cases X-ray and radium may be used as a palliative measure. However, the bowel and bladder are usually involved and the growth so widespread that radiation may prove of doubtful assistance.

Myomata of the Uterus.—X-ray and radium will at once check the hemorrhage associated with myomata and will induce a gradual diminution in the size of the tumors. There are manifest disadvantages to radiation, however, so that its use should be limited.

In the first place it is uncertain that the entire myoma is removed; secondly, myomata are usually associated with pelvic adhesions, non-

infectious irritations, frequently with specific tubal infections, and occasionally with necrosis. These conditions are aggravated after radiation and may actually increase the mortality rate. In nulliparous women with small single, pedicled or accessible myomata, surgical removal may be done with a conservation of the childbearing function, while radium in large doses sterilizes such a patient. Lastly, radium and X-ray treatment reduce the size of myomata so slowly that, in the presence of pressure symptoms, partial intestinal obstruction, hydronephrosis or pyonephrosis, radiation is too slowly acting to be safe.

On the other hand, radium and X-ray require no anesthetic, have no primary operative mortality and will cause cessation of hemorrhage in a patient who is too ill to withstand laparotomy. The artificial menopause causes fewer symptoms than an operative removal of the ovaries. The use of radium does not contra-indicate later operation if necessary for other reasons. As to the risk of associated malignancy, Anspach gives the incidence as sarcoma in 2 per cent of all myomata and in 9 per cent of submucous tumors. X-ray and radium treatments ought to be curative of such unsuspected growths, if applied generally over every area.

All myomata that can be removed without impairing the childbearing function should be operated upon. Tumors that are so large as to cause pressure symptoms, those from which associated degenerations or inflammations cannot be excluded, should likewise be treated surgically. Radium and X-ray should be limited to those cases manifesting marked hemorrhage, who cannot take a general anesthetic by reason of some constitutional disease, and in whom the tumors are free from infection and have not reached the size of a four months' pregnancy.

The dosage is 100 mg. inserted in tandem tubes to reach all parts of the cavity and allowed to remain from twelve to twenty hours. In addition, heavy X-ray dosage may be applied over the lower abdomen.

Uterine Hemorrhages.—Excessive uterine hemorrhage not due to malignant disease but depending upon changes in the uterine musculature, symmetrical hyperplasia of the endometrium, functional disturbances of the ovary, or chronic cardiac and renal disease, may be promptly checked by the use of radium or X-ray. The direct application of a small amount of radium within the uterine cavity is preferable to the X-ray, for in this way the dose can be more directly controlled. When the hemorrhage is profuse and the patient is over forty, it is immaterial if sufficient dosage is administered to produce an artificial menopause and sterility. The problem becomes more serious in recommending radium to a young woman whose childbearing function has not yet been completed. Under these circumstances, Clark and Graves apply radium in a dosage of not over 600 mg. hours and have reported successful pregnancies subsequent to the treatment.

Treatment by Cautery.—The actual cautery is useful to sterilize infected areas such as a chronically infected cervix, to remove benign neoplasms such as veneral warts or fibromata from the vulva, and to assist in extirpating malignant growths such as carcinomata of the vulva or cervix. There are three types of cautery: (*a*) the benzin vapor hot point; (*b*) the electric cautery; and (*c*) the "cold iron" Percy cautery.

The first of these is a round, blunt-tipped, white-hot cautery, which is of service in touching small areas, but which cannot make a linear cut and is therefore not of use in the small cervical canal. The electric cautery is most universally serviceable, for the temperature of the tip can be regulated by a rheostat and the various sized tips which may be substituted one for the other meet every requirement. Large growths may be removed by the electric knife without risk of transplanting malignant tissue. The Percy cautery consists of various shaped tips of white metal, which are heated by electrical resistance and which are designed to destroy carcinoma cells in the uterus by slowly and moderately heating the affected area.

Anesthesia is of course required for most procedures in which the cautery is employed. Under general anesthesia the use of hot irons is not without risk, for healthy tissues, if not properly protected with wet sponges, may be burned. Moreover, if the burned area is extensive, there is danger of protein intoxication from absorption. Even for the removal of fibromata or condylomata, local anesthesia is necessary. On the other hand, a linear cauterization of the cervix may be done or venereal warts removed without its use.

It is advisable that any one undertaking such therapy had best familiarize himself with the apparatus he contemplates using and with the original articles of Hunner and Percy.[1]

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CHAPTER VII

THE USE OF SERA AND VACCINES IN OBSTETRICS AND GYNECOLOGY

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In the past it has been particularly true of this department of medicine that new cures have been heralded with great acclaim, widely adopted, and as rapidly forgotten. The natural reparative powers of the body, the self-limitation of certain affections, and the natural tendency in many diseases to spontaneous cure were not properly understood, and the return of a patient to health was attributed to the particular therapeutic measure employed. As a rule most of the principles of treatment were drastic, and lost sight of the tenet that the first qualification of a cure is that it shall do no harm; so that quite frequently, aside from those measures adopted to increase the general tone of the patient, the therapeusis did the patient more harm than good. The truth of this assertion may be best appreciated by a study of the history of the treatment of puerperal infection. The literature is crowded with specific cures. Intravenous injections of formalin, mercury, and other potent poisons; intra-uterine douches of carbolic acid and of various other medicaments of equal capacity for harm; curettage as a routine treatment; and even major operative procedures have from time to time been advocated as the principle hope in the treatment of this dreaded affection. Contrast our treatment in the larger clinics to-day. Fresh air, an abundance of good food, and rest in bed are the essentials of the modern treatment of puerperal sepsis. Often all that is done beyond this is directly harmful. The eradication of the disease itself is as yet beyond our power; all we can do at the present is to increase the natural defenses of the body.

It requires time and the observation of a large number of cases to judge the value of the effects of a new procedure; only in isolated instances can judgment be based upon the results obtained in a few cases or by a single observer.

Biehn lists some common causes for failure of bacterin therapy, such as incorrect diagnosis, improper bacterin, improper dosage and improper concomitant therapy. The latter cannot be overemphasized as one should not be content to sit back and let bacterin therapy overcome huge obstacles.

SERUM, DEFIBRINATED BLOOD, AND WHOLE BLOOD IN THE TREATMENT OF HEMORRHAGIC DISEASES

The results obtained in the treatment of certain hemorrhagic affections by the use of serum, defibrinated blood, or whole blood are often extremely gratifying. It appears that the bleeding may be due to the excess or deficiency of certain substances present normally in balanced amounts.

In order to understand the pathology of bleeding it is necessary that something be known of the physiology of clot formation. Howell believes that a small amount of antithrombin is present in the normal plasma, and is sufficient to bind the prothrombin. Thromboplastin is set free by cell injury, and neutralizes the antithrombin; this releases the prothrombin, which at once combines with calcium to form thrombin. The free thrombin coagulates the fibrinogen, and the normal clot is produced. Some of the agents necessary to the normal production of clotting may be present in abnormal amounts, and thus a delayed clotting time result. Whipple, in a study of the various factors in abnormal clotting, ascertained that the balance existing between antithrombin and prothrombin is variable, and should be studied before treatment is administered. The hemorrhage may be due to an excess of antithrombin, or to a decrease in the prothrombin. It is believed that antithrombin is produced in large part by the liver, and in some diseased conditions may be produced in excess.

On theoretical grounds it does not appear reasonable in a case where antithrombin is in excess to introduce into the circulation defibrinated blood which is itself rich in antithrombin. When antithrombin is in excess the hemorrhage should be treated by a direct transfusion of whole blood. Whipple reports a case in which there was an excess of antithrombin where the use of defibrinated blood seemed to accentuate the hemorrhage. In prothrombin deficiency, on the other hand, serum makes up the deficiency, and is efficacious, though defibrinated or whole blood may be used. It is thus seen that the choice between serum, defibrinated blood, and transfusion in a given case of hemorrhage may not be a matter of indifference. However, our knowledge concerning these hemorrhagic affections is not extensive, and it is impossible always to explain the effects of successful therapy. For some time it has been known that the serum of another individual or animal, when injected into a person suffering from a hemorrhagic affection, is capable, in many instances, of stopping the bleeding.

When the patient is in imminent danger of death from exsanguination the indication is for a direct transfusion; but when there are repeated small losses of blood, from which the system can recover providing the bleeding is fairly promptly checked, either defibrinated blood or serum

may be effective, unless the cause lies in antithrombin excess, in which event Whipple believes that their use is contra-indicated.

In some cases normal horse serum seems to be as effectual as human serum so far as the arrest of hemorrhage is concerned, yet its employment is so intimately associated with the dangers of anaphylaxis, the ultimate consequences of which we are only beginning to appreciate, that its use should be restricted to cases where a satisfactory human serum is not obtainable, or where the initial dose cannot be delayed until the donor can be sufficiently investigated. In such an instance a single dose of horse serum may be given, to be followed later by human serum.

The usual dose of serum is from 20 to 30 c.c. at an injection, and this amount is to be repeated from two to six times in the twenty-four hours. In cases suited to this form of treatment bleeding usually ceases within that time. Normal horse serum is procurable on the market in the same form as the various protective sera. Antidiphtheritic serum may be used if normal serum is not available.

Selection of a Donor.—As much care should be exercised in the selection of a donor for serum as is usual for direct transfusion. A careful physical examination, a searching history, and a negative Wassermann reaction are prerequisites. The only permissible deviation from this rule is when the blood of one of the parents is to be used for the treatment of their newborn child. Not only should all the evidence be negative, but the history should be above all suspicion. No case is so urgent that a questionable donor should be taken, even if all tests are negative. The taking of a donor solely because she is the mother of apparently healthy offspring cannot be too severely condemned. It is true the chances are small that such a selection would be followed by disaster, but harm has occurred so frequently from this sort of "reasoning" in the choice of wet nurses that no condemnation is severe enough to characterize the one who disregards modern methods of guarding against the possibilities of transmitting syphilis by his random choice of a donor of blood or of some of its components.

The blood may be obtained as in venesection, allowing from 200 to 300 c.c. to collect in a sterile flask or beaker, but it is best procured by a more careful technic. A constrictor is placed tightly about the biceps, and the region of the cubital vein surgically cleansed. The vein is entered with a needle and the blood withdrawn into a sterile container. The constriction is then removed, the syringe drawn out, and the puncture point compressed for a moment and sealed with collodion. The donor experiences no unpleasant sensation aside from the prick of the needle.

If defibrinated blood is desired the blood is immediately beaten with a sterile rod or stick, or shaken in a flask with sterile glass beads before clotting has time to occur. The fibrin separates, leaving the blood ready for use. If serum is wished the vessel is put aside at room temperature.

Usually within an hour enough serum exudes for the first injection. Sakoguchi advises leaving a sterile stick or folded wire of sufficient size to protrude above the surface of the blood; the blood will clot about this object, which can be removed, leaving clear serum. Since serum rapidly deteriorates, the supply should be kept upon ice and great care used to prevent contamination. If the serum becomes cloudy its use sometimes produces slight fever. It should not be given when kept longer than forty-eight hours, as the complement-content rapidly lessens on standing.

Dosage of Serum.—Failure frequently results from insufficient dosage. Thirty c.c. are to be given at a dose, and this dose is repeated, according to the necessities of the case, twice daily, or every four hours, until the desired result is obtained or failure is demonstrated. Usually the treatment is effectual within twenty-four hours, and may be discontinued within forty-eight hours. The injections are made with a syringe that has been sterilized by boiling. The injections are given subcutaneously or intramuscularly into the tissues of the thigh or back. The intravenous method of giving defibrinated blood should be practiced only by those who have had experience, because of the danger of embolism.

Serum in the Treatment of Uterine Bleeding

Occasionally one meets with individuals in whom, in the absence of accountable local pathology, the menstrual periods are profuse and debilitating. Quite frequently the subjects are young girls in whom the underlying cause is, perhaps, a disturbance in the internal secretions, and yet all attempts at amelioration of the condition may fail. Many are subjected to curettage with the idea that there may be an abnormal endometrium. If, upon curettage and examination of the scrapings, no pathology is found the bleeding will probably continue without change or, at best, improvement will be only transitory. Good results have been obtained in this class of cases by the injection of human serum, defibrinated blood, or normal horse serum. A single dose of 1 or 2 ounces of serum or defibrinated blood is often followed by permanent relief; occasionally the treatment must be repeated in three or four months.

Before this treatment is instituted the physician must absolutely eliminate the presence of pelvic disease, the delay of suitable treatment of which would be detrimental; and he should especially bear in mind that there is no age limit for cancer of the womb, since it has been found in girls under twenty years of age.

In addition to the hemostatic effect, treatment by serum or blood seems to be directly stimulating to the production of red cells. Zubrzycki and Wolfsgruber report that, in women suffering from carcinoma of the cervix, they succeeded by the use of 140 c.c. of defibrinated blood in raising the hemoglobin from 25 to 35 per cent, and the reds from 1,500,000 to 3,800,000 during the course of four weeks.

W. Meyer has used normal human serum in the prophylaxis and treatment of the parenchymatous hemorrhage occurring after operations upon subjects suffering from icterus and hemophilia with encouraging results. He gave from 1 to 2 ounces three times daily for two days preceding, and for at least two days following, operation.

Chatton gives intravenous injections of isotonic serum with sodium citrate in the treatment of uterine hemorrhage.

Dupont treated one case with Vanaver's antistreptococcic serum with recovery.

Abel has prepared a styptic substance which he calls "metrotonin," particularly strong in styptic qualities, which he has found of value in uterine hemorrhage and inflammatory conditions leading to uterine hemorrhages, and also in hemorrhages in connection with labor and abortion. Its action is upon the uterine musculature. It can be used either subcutaneously or intravenously. The composition is adrenalin hormone mixed with acethylcholin.

Human Serum in the Induction of Labor

The essential factor that brings about labor has not as yet been satisfactorily determined. That it is some substance that gains entrance to the blood and thus brings about uterine contractions, and that this substance is probably of the nature of a hormone, has long been believed. The observations made on the Blazek twins, the behavior of animals joined together in symbiosis, the results of animal transfusion, show that there is something, previously absent, which appears in the blood of the pregnant woman at the time of labor.

Heyde thought that he might bring on labor prematurely by the injection of serum obtained from women in labor. He was enabled to bring about uterine contractions thereby, but did not succeed in inducing labor. Thinking that the necessary substance was fetal in origin, and consequently present in the mother's serum in such dilution as not to be demonstrable, he tried the same experiments, using the serum obtained from the blood coming from the cord after the release of the child. Upon the injection of this serum he obtained undeniable effects.

Rongy has duplicated these results in 19 women. In 6 women who were from ten to eighteen days from term one or more injections induced labor pains which terminated in birth. In 7 patients the results were entirely negative, while in the remaining 6 the contractions were transitory. He reports that frequently after the injections there were chills, nausea, and vomiting, and, sometimes, precordial pain and oppression. This very interesting work is purely experimental and has not been adopted in active therapeutics.

Normal Serum in the Treatment of the Intoxications of Pregnancy

Schmorl and Veit have described the presence of placental elements in the free circulation of the pregnant woman. Considerable proof is at hand that an increase in the digestive power of serum occurs in pregnancy, and that these digestive ferments are elaborated for the purpose of freeing the blood-stream of placental elements. It is thus supposed that there are produced in the blood-stream of the normal pregnant woman protective bodies in sufficient amount, while in those women who come under the classification of intoxications of pregnancy these bodies are insufficient to overcome the noxious effects of the placental products. The attempt was therefore made to relieve certain of the intoxications of pregnancy by the injection of the serum of normal pregnant women.

Reports have been published dealing with this usage in not only eclampsia and the pernicious vomiting of pregnancy, but especially in the dermatoses. Richard Freund reviews the results of the serum treatment of the intoxications of pregnancy in the German literature, and finds that of the dermatoses, under which are included cases of herpes gestationis, urticaria, pruritus, lichen urticatus, general prurigo, and pemphiguslike dermatitis, 12 cases were treated. Some found complete relief immediately upon the injection of from 10 to 25 c.c. of serum, while others required a repetition of the dose. When the stubborn nature of these affections is considered these results are encouraging. Of the cases suffering from hyperemesis there were 5; in 2 cases there was immediate benefit; in 2 marked cases repeated injections failed to give relief, and pregnancy had to be terminated; in 1 case vomiting ceased six days after treatment. The results in pernicious vomiting are such as may be obtained from any therapy, no matter what its nature. Other cases are reported where the serum seemed to stop the vomiting, but the women later aborted. In such an event one must not overlook the possibility that the cessation of vomiting coincided with the death of the ovum. Serum from pregnant women, combined with venesection, was tried in 6 cases of eclampsia, with results that could not be credited either for or against the treatment.

Freund shows that the effect of this treatment apparently is not dependent upon the presence of protective bodies in the serum of normal pregnant women, since just as good results were obtained when normal horse serum was used. He believes that the results of its use are ascribable to the calcium content of the serum rather than to any specific substance, since, in 15 cases of dermatoses of pregnancy treated with injections of from 150 to 200 c.c. of Ringer's solution, the eruptions very promptly disappeared. Rissman was also able to effect a very prompt

and permanent cure in 3 dermatoses of pregnancy by the injection of 165 c.c. of Ringer's solution, the symptoms beginning to recede within a few hours of the injection. Since this medication is freer from harmful possibilities, it had better be tried in these resistant intoxications before submitting the patient to the administration of serum.

Vinnay reported a case of hyperemesis gravidarum which he treated by direct transfusion of blood from a normal pregnant woman. Vomiting almost completely ceased after the transfusion, though she developed a mild icterus and aborted two months later.

Austin reports 9 cases of pernicious vomiting treated with only 1 failure. In this case the isoserum was used.

The Use of Antistreptococcus Serum

When antistreptococcus serum was first introduced the profession was very hopeful that it might cure the many cases of streptococcus infection which has so consistently resisted all attempts at treatment in a high percentage of cases. Especially in puerperal infection the prospects seemed bright of ridding that malady of its terrors. Therapeutic results obtained with the serum did not demonstrate its efficiency, and after a short period of popularity serum was much less used.

More recent experimental work by Weaver and Tunnicliff shows that in animals the injection of antistreptococcus serum is followed by an increased phagocytic power of the leukocytes of brief duration, and an increased opsonic power for streptococci for a period of about ten days, and that animals can be protected by serum against doses of streptococci that are uniformly fatal to control animals. Their attempts, however, to treat well-established cases of infection were not successful.

These workers draw attention to the facts that antistreptococcus sera rapidly lose their opsonic power, and that one is not certain of procuring an active serum. If the serum is to be used the dosage must be large, from 30 to 100 c.c. Weaver further advises that if the serum is to be used in a curative way it should be given early, and if one wishes to obtain a rapid effect it should be administered intravenously, or, when this is impossible, intramuscularly, though by this route the effect is somewhat slower. The subcutaneous administration apparently can show no effects before about twenty-four hours. The benefit of the medication should be shown by a prompt fall in the temperature, an increase in the opsonic index, a reduction of the leukocytosis, and by the clinical improvement of the patient's condition. When the improvement comes to a standstill, when the leukocytes again increase, or the opsonic index falls, a repetition of the dose is indicated.

In view of the experimental results, the use of antistreptococcus serum is indicated early in the course of an infection, especially when the possible

dangers from its use are minimal compared to the possibilities of benefit. The results obtained by the use of serum in streptococcus puerperal infection, however, require careful interpretation and large clinical experience, for the reason that infections by the streptococcus show wide and sudden variations of the clinical picture independently of therapeutic measures. The interpretation of results obtained when the serum is given early in the infection requires especial care. In this stage we see many quick returns to the normal, no matter what the therapy. No conclusion based upon an isolated case or upon a small number of cases is allowable.

Beruti finds that in severe puerperal infections the use of non-specific serum gives equal or better results than the specific serums giving a dosage greater than 20 c.c. He also believes that local application of non-specific serum is the rational method in the early treatment of puerperal infection, provided this latter has not become generalized; also that the regenerative action of warm horse serum is undoubtedly favorable.

The largest field of usefulness, judging from the experimental data, is in the prophylactic treatment of streptococcus infections. The high mortality rate in the operation for the radical cure of cancer of the uterus is due largely to the peritonitis engendered by the entrance of streptococci into the peritoneal cavity through the opening of the infected vagina, or by the rupture of infected lymph-nodes during the operation. To minimize the danger of a postoperative peritonitis it has been advised to take a culture from the vagina in such cases, and when streptococci are demonstrated to immunize the patient by the administration of an autogenous vaccine and antistreptococcus serum. The same may be done when a radical operation is to be performed for the removal of a vaginal or abdominal fistula which yields streptococci, no matter if the patient has been temperature-free for a considerable time. During operations for the removal of pus tubes rupture of a tube is frequent in spite of the exercise of extreme care. In acute cases the pus often contains streptococci, and for this reason clinicians avoid by all safe means operations on pus tubes during the acute stage. In chronic tubes the pus is usually sterile, but occasionally it contains streptococci, which may usher in a fatal peritonitis. It has been suggested that, whenever pus escapes during an operation for pus tubes, a smear and a culture should be made, and, in case streptococci are found, an early prophylactic dose of antistreptococcus serum should be given.

That the patient recovers after the administration of the serum in such a contingency is not direct evidence of the effect of the serum, however, since patients frequently recover with little disturbance where streptococci have been found in the pus escaping from a tube during operation. In this connection it must be remembered that the streptococcus is frequently the secondary invader of a tuberculous or gonorrheal tube, so that the

clean-cut clinical history, or typical appearance of the pathology, does not prevent the cautious man from minutely examining spilled pus.

In obstetrical cases that have been dirtily handled, or where for some other reason it seems probable that the patient will develop a puerperal infection, a prophylactic dose of antistreptococcus serum may be given. Of course it is not certain that the infection, should it occur, will be due to the invasion of streptococci, yet the chances are great that this organism will be the cause of the infection.

Treatment of Puerperal Infection by Vaccines and Sera

Under puerperal infection we include any infection of the genitalia which manifests itself by the appearance of fever during the puerperium, no matter how brief the duration, what the infecting organism is, or how limited or extensive the area of infection. The patient may seem extremely ill, and within a few hours be temperature-free, or, with the same initial symptoms, the patient may be ill for weeks. A perineal tear may be the only seat of infection, or the patient may have every pelvic organ, and even distant organs, involved. There is no criterion by which to prognosticate the outcome in a given case, and especially is there no way of judging the intensity of the disease in reported cases. Organisms may be cultivated from the blood of a case that recovers, while repeated attempts may yield sterile cultures in a fatal case. The results of cultural examination of the lochia allow of no prognostic conclusions. No affection holds so many surprises. A patient on the third day of the puerperium may have a violent chill with high temperature, and the next day return to the normal course of convalescence. Another patient may have fever for days and then suddenly begin to improve for no accountable reason. Because of these facts the experienced physician hesitates to ascribe a recovery to a single therapeutic measure. It is almost impossible to form any conclusions as to the effect of therapy in this affection, because of the great variations mentioned above. The clinical results must be uniformly striking in large series of accurately reported cases, or reliable laboratory methods must show undeniable evidences of benefit before men of experience will be willing to agree to any advocated therapy specific power.

Thus far the advocates of vaccine therapy in puerperal sepsis have failed to produce these necessary proofs. On the contrary, there is every evidence to support the belief that vaccines employed in cases suffering from sepsis may be directly harmful. In the laboratory, where exact conditions can be produced in experimental and control animals, vaccines given in sepsis are either without effect or are directly detrimental. The use of sensitized vaccines may yield better results.

When, however, the fever has receded and a localized inflammation is left, vaccines may be employed. Abscesses that have been drained and,

though producing no fever, refuse to heal frequently react promptly to vaccine therapy. With this possibility in mind it is advisable to make cultures of all abscesses at the time of operation, for the attempt to get cultures later may be difficult or impossible.

Infections of the puerperal breast are frequently chronic. The original abscess may be slow to heal, or multiple foci may appear, producing little or no fever. Breast abscesses, in a considerable percentage of cases, are due to the staphylococcus.

Whatever the organ involved the causative organism must be identified before success with vaccines can be expected. Here, as elsewhere, the percentage of cures is increased if the vaccine is made from the organisms infecting the patient.

Krongold-Vanaver reports cases treated in which apparently the streptococcus has not markedly cleared the uterine barrier. Of the 36 women treated with serum all recovered. In 5 cases where the streptococcus had cleared the uterine barrier there were 3 deaths in the treated cases. Great emphasis is laid on giving the serum following the recognition of the streptococcus and before subjective signs are apparent.

Costa has opposite results in that the serum therapy was not followed by appreciable improvement.

Gowe uses intravenous peptone solution (Witte) with good results.

In reviewing the literature on the treatment of puerperal sepsis by sera and vaccines, most of which does not appear in this article, one cannot refrain from quoting the statements of Murray who also noted that the literature is chaotic:

"It is apt to be either disappointing (or encouraging). If every one publishing a case report would give the details of the patient's condition, the local condition, dose, amount of serum used and method of inoculation, it would be much easier for the reviewer to draw definite conclusions."

Murray calls attention to the treatment of symptoms in the second week. In these late-appearing symptoms the infection is apt to be vascular in origin and pyemic in development. The staphylococcus is more frequent in this type. Here autogenous vaccines give excellent results obtained from blood cultures. Immunized serum may be of some value.

VACCINE TREATMENT OF GONORRHEAL INFECTIONS OF THE FEMALE GENITALIA

In order to interpret the results of the vaccine treatment of gonorrheal infections in women, certain of the facts concerning the peculiar pathology must be borne in mind. Unlike the fresh infection in man, which is

usually associated with more or less discomfort that forces the subject of the infection to seek relief, gonorrhea in women, unless accompanied by urethritis, very frequently runs its complete course without producing symptoms suggesting its presence. The usual female sufferer from gonorrhea presents herself to the physician because of the late manifestations of the disease, chronic endocervicitis, endometritis, or because of a bartholinitis or pelvic inflammation. Smears taken from the accessible surfaces at this time may show no diplococci, either because they are so diminished in number as to escape detection, or because they have disappeared and other invaders have taken their place. More reliable than the examination of smears is the investigation by means of cultural methods. However, even with good technic a negative culture does not acquit the case of suspicion, because the organisms may be located in inaccessible crypts.

The gynecologist is frequently confronted with a patient whose clinical history is definite, and in whom every fact points directly to the conclusion that the woman is suffering from the consequences of a gonorrheal infection. The husband tells of specific urethritis immediately preceding his wife's illness, the onset of her sickness is typical in every detail, she is treated medically as an undoubted case of gonorrheal infection, and yet, when operated upon because of invaliding pus tubes, the tissues and pus submitted to bacteriological investigation reveal no gonococci. The case is undoubtedly gonorrheal in origin, but other organisms, the colon bacillus, the staphylococcus, the streptococcus, or anaërobic organisms, are now present, and the original organism has disappeared from the tissues. The more remote the original infection the less the chance of finding the gonococcus. In the presence of fairly large collections of pus there may be complete absence of all organisms. Thus Wertheim, in an examination of 116 pus tubes, without respect to their duration, found that 72 were sterile, while Martin found sterile pus in 73 out of 109, and Menge in 68 out of 106 specimens. Improved cultural methods probably will show a smaller percentage of sterile examinations, but the fact remains that pus tubes are frequently sterile.

Granting that the gonococcus has been found in the smears or cultures from the cervix, is this proof that the swellings in the pelvis are due to the gonococcus? It is strong evidence, but not conclusive, as those who operate upon such cases soon learn. The cervicitis may be recent, and the tubal disease an old tuberculosis, the remnants of a postabortive or puerperal infection, or, even in the presence of the strongest circumstantial evidence, the swellings may not be inflammatory at all. If, under such circumstances, the cervical inflammation is the condition that is to be treated, then the use of gonococcus vaccine may be considered, but if the patient is to be treated for the pelvic swellings the evidence that she is suffering from an existing gonorrheal infection of the appendages must

be established upon reliable data. If the patient has a gonorrheal urethritis, and at the same time a tuberculous salpingitis, no one can expect to rid the patient of her tubal symptoms by the administration of gonococcus vaccine.

The internist does not administer vaccines to a case of arthritis without an attempt to determine the etiology by searching for the causative organism in the articular fluid or in the glands draining the joint. This cultural evidence failing, he may give a vaccine upon the basis of other evidence, but in so doing he feels that his chances of success are certainly decreased. In the same way direct evidence should be sought as to the organism existing in the tube at the time that vaccine therapy is instituted, if one expects beneficial results. This evidence may be gained by vaginal incision, or by the use of the exploratory needle. Vaginal incision may be directly curative in itself, but the vaccine should be made from the pus obtained and held in readiness for later use. The exploratory needle is so slender that it may often be used for securing pus in cases that are not suited to vaginal drainage. When the evidence is strong that the gonococcus is the organism in question, yet reliable proof is not obtainable, the case may be treated tentatively with gonococcus vaccine, provided it is clinically ready for vaccine treatment. Success or failure cannot be definitely credited either for or against vaccine therapy in such cases.

There would not be so much controversy to-day concerning the success of the vaccine treatment of gonorrheal affections in women if clinicians should definitely determine in an incontrovertible way that the diseases of the appendages that they are attempting to treat are due to active gonococcal infection. The simple statement that the cases treated are suffering with gonorrheal tubes is not sufficient. Etiologically the chance of the correctness of this diagnosis is great, since Wertheim and Menge are the sponsors for the statement that 82 per cent of all pus tubes are gonorrheal in origin.

We will grant that the patient is suffering from a gonorrheal infection. Before we treat her in any way at all we must know what chances she has of recovery without medication if we are to be able to judge competently of the effects of therapy. As stated, the infection may be limited to the cervix, to the urethra, or to the entire lower genital tract without ascension and recover completely without attracting any particular attention. Even after the tubes are involved the symptoms may be slight. Cases are occasionally operated upon for sterility in the absence of any history of previous illness, and evidences of an acknowledged gonorrhea of the husband found in the closed tubes of the wife. Even after a violent attack of salpingitis one may see a rapid shrinkage in size of the tube and a return to normal function, as demonstrated by subsequent pregnancies. In general, however, the effects of gonorrheal infections of the fallopian

tubes are of long duration, and are associated with an amount of pain that is disproportionate to the other clinical symptoms.

A study of available statistics shows that the usual non-operative treatment of gonorrheal infections of the tube results in a symptomatic cure in from 50 to 90 per cent of the cases, or an average of about 70 per cent. The objective cures also vary greatly. Fromme and Collman had 30 per cent of recoveries, Forsner had 20 per cent, while Cukor reports as high as 52 per cent of satisfactory results. Probably a conservative average of complete objective cures would be about 30 per cent of the cases. When studying the results of vaccine therapy of gonorrheal infections in women, no conclusions can be based upon isolated cases, but the results of its use must be compared with those obtained by the usual conservative methods of treatment.

Heinsius treated 10 cases of probable or proved gonorrhea in women with vaccines. Eight tubal cases gave good results, the duration of treatment averaging four weeks. A case of cervical gonorrhea was improved. The only instance in which treatment was without influence was one of subacute cystitis.

Fromme and Cullman treated a number of urethral, uterine, and cervical infections, in which the gonococcus was identified, without the slightest result. In fact, they saw bartholinitis and ascension of the affection occur in spite of treatment. In 45 cases of pyosalpinx, in which they either isolated the organism or obtained an unquestionable history, they secured good results. They noticed regularly a subsidence of the subjective symptoms. In 10 of the 45 tubal cases a complete objective and subjective cure was secured, while 19 were subjectively cured and objectively markedly improved (decreased size of swellings, etc.). Six cases received only slight benefit, and 10 were not benefited. They therefore obtained 64 per cent of satisfactory results. Regarding an objective cure they remark that one cannot demand a complete restoration to normal from any treatment in old cicatricial tubes in which extensive connective tissue changes have occurred.

Schindler says that he has not been able to influence cases of mucous membrane infection, but has obtained notable results by the use of vaccines in gonorrheal tubes.

Slingenberg is guarded concerning his experience with cases of vulvovaginitis, but thinks that cervical and uterine infections are favorably influenced by vaccines, that the bleeding lessens, and the discharge disappears. He does not give his results in detail.

Heynemann treated 5 cases of gonorrheal tubes with gonococcal vaccine without appreciable results.

Friedländer saw complete restoration to normal in 3 cases of recent tubal infection after four weeks of vaccine therapy.

Dembskaja treated 200 women having various lesions, and after two

years of observation saw no return of trouble in the 50 per cent that were apparently completely cured.

Sternberg and Jelkin undertook the treatment of 278 cases, of which 200 were probably gonorrheal. Among these women were 163 suffering from infection of the appendages and periuterine structures. They obtained satisfactory subjective and objective results in 142 of the 163 cases. The treatment lasted from three to eighteen weeks, on an average of 10 weeks, and required from five to thirty-six injections.

Terebinskaja and Popowa question Sternberg and Jelkin's results. They treated 13 cases of positive gonorrheal tubal infections with the same vaccine and saw no favorable results attributable to it.

Neu tried the effect of vaccines on 26 cases of positive and probable gonorrheal infections of the tubes among the ward cases at the Heidelberg Frauenklinik, and was not able to observe any results that he could credit to the beneficial effects of the vaccine treatment, with the possible exception of 1 case.

Heymann and Moos obtained no benefit from vaccines in urethritis and endometritis. In 44 recent adnexal swellings they obtained excellent results in 5 instances, improvement worth mentioning in 12 cases, slight but recognizable improvement in 18 cases, while there were 9 that remained unimproved. In 9 old tubal swellings 7 were not benefited, while 2 were slightly improved. They conclude that the gonococcus vaccine has not proved to be an advance in the treatment of gonorrheal infections of the uterine appendages.

Hauser carefully analyzes the results of treatment in 18 cases of tubal infection, which were probably gonorrheal in origin, and relates that he obtained 5 complete objective and subjective cures and 6 satisfactory cures, in that the patients were relieved of all symptoms, though retaining altered tubes. He believes that vaccine treatment promises from 10 to 20 per cent better results than does any other non-operative treatment.

Klause was not able to secure as good results in adnexal disease as in epididymis and joint infections.

Vaccines in Vulvovaginitis

Fitzgibbon treated 6 cases of gonorrheal vaginitis by the use of vaccines. Of these 3 were children, 2 were adults with old infections, and 1 was an adult with a recent infection. Four of his cases exhibited a steady improvement until they were cured. Two improved and then relapsed. One of the 2, however, eventually recovered. All cases received local treatment in addition to the vaccines.

Hamilton treated 84 cases of vulvovaginitis in children and obtained a complete disappearance of the secretion in 76 instances. The treatment

averaged 1.7 months instead of 10 months, as required for other methods of treatment.

Butler and Long report that they were able to cure 11 cases out of 18 treated with vaccines, and the treatment averaged only fourteen days.

Churchill and Soper report equally beneficial results in a series of 41 cases.

Boas and Wulf treated 9 cases of vulvovaginitis without clinical benefit, though the opsonic index was increased.

Barnett, in 15 cases of vulvovaginitis treated by vaccines, was unable to influence the vaginal secretion, though he secured cures of the joint troubles in a few cases where this complication was present.

The pediatrists apparently have had more success in the treatment of their cases of vulvovaginitis than the gynecologists. While the former have noticed favorable results, the latter almost uniformly report failures in their attempts to influence any of the mucous membrane infections, whether vulvovaginitis in children, or cervical, uterine, or urethral infections in adults.

The most favorable cases for treatment by vaccines are recent tubal infections after the subsidence of fever. When once there is extensive connective tissue alteration with the production of scar tissue no treatment can cause its absorption. Some of the failures are ascribable to the presence of a secondary infection which is not influenced by the gonococcus vaccine. Vaccine does not seem to lessen the chances of tubal involvement when given prophylactically in the beginning of a gonorrhea. When drainage of a pelvic abscess is indicated it should not be deferred in order that vaccines may be tried.

Practically all observers are united in the advice not to give the vaccine in the presence of fever or during the menstrual period.

Other rules for treatment by gonococcal vaccines are the same in pelvic infections as in other gonorrheal affections.

Jack reports 6 cases of vulvovaginitis in children with no appreciable improvement when treated with gonorrheal vaccine.

Lactic Acid Bacilli in Vaginitis

Many investigators believe that the vagina is in part protected from the invasion of foreign bacteria by the activity of certain Gram-positive bacilli described by Doederlein, which are found in the normal vagina. Sporadic attempts have been made to utilize this organism therapeutically in infections of the vagina, but the cultivation of this organism is extremely difficult, and no systematic study of this subject has been made. Brindeau has, however, used for this purpose cultures of other bacilli which produce lactic acid. He believes that cultures of the Bulgarian lactic acid bacillus are useful, not only in the vagina, but that they hasten

the cleansing of other wounds. He mixes the contents of a culture tube with a solution of milk sugar and pours this into the vagina or over the wound that is to be treated. An overdose, he says, is impossible, since this organism is not pathogenic, and the stronger the culture the more rapid the action. Since the principal rôle of Doederlein's bacillus appears to be the production of lactic acid, which renders the vaginal secretion inimical to the growth of most other bacteria, Brindeau's advice seems to be biologically well grounded when applied to vaginal infections, and worthy of trial especially since the therapy appears to have no possible bad effects.

TREATMENT OF FEMALE GENITAL TUBERCULOSIS BY THE USE OF TUBERCULIN

The treatment of female genital tuberculosis has not found the warm support that has been accorded the use of tuberculin in some other forms of tuberculosis. Those who have had experience in observing these cases of tuberculosis of the tubes and peritoneum almost without exception support the operative treatment as offering more hope of cure. Franque expresses the opinion of most abdominal surgeons when he says that this variety of tuberculosis is best treated by operation. When there is coexistent lung or other involvement, which in itself is not capable of repair, the pelvic disease is, of course, not suited to operation. But when the genital involvement occupies the most prominent part of the clinical picture, an operation for the removal of the local disease should be considered. Neu in a review of the 82 cases of genital and peritoneal tuberculosis treated at the Heidelberg Frauenklinik from 1902 to 1910, found that, of the 55 cases that were operated upon, 75 per cent were still alive, while of the 21 milder cases that were treated conservatively only 52 per cent survived. In cases that are considered too advanced for operation tuberculin may be cautiously given under the direction of a physician experienced in its use.

PYELITIS OF PREGNANCY

Pyelitis of pregnancy is a frequently overlooked condition in pregnancy and the puerperium, so that on many occasions serious errors in treatment have been made. This has been the experience of the authors in many cases.

Etiology.—B. coli is the most frequent organism though other pyogenic bacteria are also observed.

The predisposing cause is generally given as a kinking or obstruction of the ureter, diminishing the urinary flow. Also residual urine with resulting stagnation gives opportunity for ascending infection. The fact that kinking is the predisposing factor is shown by the prompt relief following ureteral catheterization and also delivery; again by the fact that it is usually located on the right side with the presence of a right torsion and right lateral flexion of the uterus.

Diagnosis.—The diagnosis is suggested by the presence of fever, chills, abdominal pain, dysuria, pyuria, and the laboratory findings of an increased number of leukocytes in the clean specimen. In the last 3 cases at Presbyterian Hospital on the authors' services the urinary pathology was not found until after an ambulance ride or car ride to the hospital, again showing the possible relief from complete obstruction. Hence one negative catheterized specimen is not enough to eliminate a possible pyelitis. Needless to say, clean or catheterized specimens are the only ones to use for examination.

Treatment.—The prophylactic treatment emphasizes advice to the pregnant woman that she must avoid a distended bladder; also routine examination of urine microscopically will reveal the infection before the subjective symptoms begin.

In the medical treatment the chief emphasis in addition to rest in bed is laid on changing the reaction of the urine every four or five days. In cases in which no relief is gained following rest in bed, baths and medication, ureteral catheterization may be resorted to, with or without pelvic lavage, earlier than in the case of pyelitis in the non-pregnant state. Following this or beginning with the diagnosis, autogenous vaccines or stock vaccines have given splendid results in the authors' services. Weymeersch and many others report good results with the use of vaccines.

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DISEASES OF THE NERVOUS SYSTEM

DISEASES OF THE NERVES

CHAPTER VIII

DISEASES OF THE SPINAL CORD

JOSEPH COLLINS AND EDWIN G. ZABRISKIE

TABES DORSALIS

Tabes, tabes dorsalis, locomotor ataxia, or posterior spinal sclerosis is a disease which depends anatomically upon a degeneration of certain sensory neurons, particularly those whose neuraxons form the posterior columns of the spinal cord and those which constitute the optic nerve. The disease is usually described as a sclerosis of the columns of Goll and Burdach; but the sclerosis is entirely secondary and is to be interpreted as the result of an effort of nature to fill the vacancy left by the degenerated neuraxons. It may be defined as a degeneration of that portion of the spinal cord constituted by the sensory neurons. Clinically the disease is characterized by a more or less progressive course, by an association of sensory, motor and trophic symptoms, which, taken together, are absolutely characteristic, and by its evolution in a more or less typical way.

Causes and Lesions.—Tabes occurs predominantly in middle adult life in those who have had syphilis. Although opinion has not been until recently unanimous in regard to the syphilitic origin of tabes, it has for a long time been admitted that from 70 to 90 per cent of all tabes patients either gave a history of syphilitic infection or bore unequivocal marks of its existence. The finished or terminal lesion of tabes is not, however, characteristically syphilitic; in other words, the decay of the posterior columns is not secondary to gummatous infiltration or any of the established types of luetic changes. Formerly the lesion was spoken of as parasyphilitic, to convey the idea that it was the result of the activity of syphilis, or of some noxious agency engendered thereby after the syphilitic poison has been deprived of the power to manifest itself in inflammatory reaction; but this conception has long since been discarded, especially when serological findings began to reveal evidence of the nature of the earliest changes.

Serological studies in tabes have confirmed in a striking manner the earlier theories of the syphilitic origin of the disease, and have increased the percentage of cases with demonstrable syphilis very considerably. Nonne believes that from 60 to 70 per cent give a positive reaction in the

blood and that the reaction in the fluid varies with the quantity used: 5 to 10 per cent with 0.2 c.c., 100 per cent with 2 c.c. According to Greenfield at the National Hospital about 10 to 12 per cent have fluids that are negative throughout.

The disease occurs more frequently in males than in females; but it is not so infrequent among the latter as was formerly thought to be the case. Among people of the better classes the number of men is far greater than women, whereas among the working class the proportion of women rises almost to the ratio of 1 to 2. It is our belief that of 1,000 cases from all walks of life and diverse nationalities, about 750 will be men and 250 will be women. It occurs more frequently in the Caucasian than in the Ethiopian or Mongoloid races, although it is by no means so rare among these types as it was formerly thought to be.

Exposure to cold, frequent, prolonged, or sudden fatigue, sexual excesses, intemperate use of alcohol and tobacco, poisoning by ergot and lead, the infectious diseases, and trauma have been considered etiological factors ever since the disease was described by Duchenne in 1861. They are contributory factors of small weight but only lead or ergot can be said to cause symptoms that in any way resemble tabes.

Oppenheim, Erb, Nonne, Kalischer, Fournier, Babinski, and others report cases of tabes in individuals who denied having acquired syphilis, but whose parents had either had syphilis or tabes (congenital type).

Heredity is of little importance. There is no doubt, however, that a defective nervous system, that is, one incapable of resistance to disease processes, may be transmitted to one or more offspring. The neuropathic diathesis is a predisposing cause. Unquestionably fatigue and leg weariness, as from long standing, forced marches, and occupations requiring exhausting use of the legs, have something to do with precipitating or possibly, even, initiating the tabes. Thus the disease is seen oftener in persons whose occupations require them to be on their feet a great deal than in persons of more sedentary occupations. We have seen 2 cases of tabes develop suddenly in men who had had syphilis, after change from a sedentary occupation for camp life preparatory to the Spanish War. Although traumatism may accelerate the progress of the symptoms, it has never been proved to be the cause of the disease, as has been urged by some. Anything that exhausts the peripheral sensory neurons and maintains the exhaustion is a predisposing cause of tabes.

The relationship of fatigue, trauma and sexual excess to the onset of tabes has been partly explained by Edinger's theory of exhaustion. Edinger bases this on the Roux-Weigert theory of balance of individual parts of the organism and assumes that all cells suffer molecular loss during activity and thereby become weaker. The loss is replaced during rest in normal individuals. In pathologic states where individuals are under the influence of certain poisons, the most common of which is syphilis,

either through undue function or faulty restitution, a disturbance of the balance of molecular loss and restitution takes place and the combined functional and structural changes ensue.

Although tabes occurs predominantly in middle life, there is practically no period at which it may not appear. Heredotabes has been reported in children from eight years upward; E. Mendel reported the case of a man infected at seventy years, who four years later developed tabes. As a rule, it appears within from five to twenty years after infection, but it may appear within one-half year, or fifty years after the chancre.

The morbid changes found in tabes occur in central and peripheral parts of the entire nervous system; the most constant lesions are: degeneration of the posterior columns, Lissauer's marginal zones, posterior horns, Clark's columns, posterior roots, spinal ganglia, and thickening of the pia-arachnoid covering the posterior surface of the cord and posterior roots. If the disease has been of long standing a sclerosis of the glia occurs, but this is always secondary, and it depends, as we have said, chiefly upon the length of time the disease has existed.

The posterior columns are usually affected only in part and in proportion to the number of roots affected. As the disease selects the lumbosacral and lower dorsal regions as the point of greatest predilection, we naturally find at these levels a fairly widespread degeneration in the fibers of the posterior columns. As we ascend to higher levels healthy fibers crowding the degenerated ones toward the median line are found, so that in a mild, well-limited lumbar lesion the degenerated fibers in the cervical cord will occupy the columns of Goll only. Frequently we find degeneration occurring at different levels, so that we may find degeneration in the lumbar cord, with isolated degeneration in the cervical levels, in which the descending tracts of the posterior columns are conspicuously affected.

The changes in the posterior root ganglia consist in granular degeneration of the intracellular fibrils, vacuolization, variations in the size and number of fibrils of the axones, and a peculiar nodular arborization of the axone which Nageotte believes to be regenerated fibers. Certain it is that, if the ganglia are obtained in the early stages of the disease, they present definite changes similar to those produced experimentally.

The other structures of the central nervous system usually affected are the descending root of the trigeminus, the gasserian ganglion, fasciculus solitarius, optic nerves, the ciliary ganglion, peripheral nerves, sympathetic, occasionally the fibers and nucleus of the oculomotor or abducens, and sometimes the hypoglossus nucleus. In cases where the disease has been complicated by muscular atrophy a corresponding lesion in the anterior horn cells has been found. In a few instances well-marked degeneration in the lateral pyramidal tracts has been found without clinical evidence to betray it.

The changes in the blood-vessels are not at all constant, and, whether

they are in the meninges or in the cord itself, the lesions are usually not characteristic of syphilis, but appear to be local reactions dependent on the chronic process in the midst of which they are. In early, fresh, uncomplicated cases there are usually no vascular changes worthy of note. The tangential fibers of the cortex nearly always disappear, and low-grade perivascular infiltrations are usually present.

The pathogenesis of tabes is still very obscure, and, in spite of all the work hitherto accomplished, there is no unanimity of opinion concerning the primary lesion. The first important step in the right direction was taken by Nageotte, 1894, who described a low-grade meningitis at the junction of the anterior and posterior roots on the proximal side of the ganglion. This view was not generally accepted at the time, as the majority of workers were unable to confirm his findings. Prior to 1894 various theories appeared from time to time, some advocating a primary sclerosis, others making the lesion dependent upon vascular changes in the roots and posterior columns, and with the advent of the Nissl stain a primary degeneration of the spinal ganglia was held by others to be the starting point of the pathological changes. Nageotte described, in addition to the meningeal process, an actual neuritis, infiltration of the perineurium, perivascular infiltration, and the presence of infiltrating lymphocytes and plasma cells in the posterior roots. The chief objection to this view lay in the inconstancy of these changes, and also in the fact that, while the anterior roots are just as much invaded by this process, the fibers do not show similar degeneration. In 1903 Marie and Guillain brought forward a hypothesis, based on experimental and histologic grounds, that tabes is really a lymphangitis of a system which includes the posterior columns, posterior horns, posterior roots, and the overlying meninges. As their reasons, especially the experimental proofs, were not convincing, the theory has received little attention, although so competent an observer as Oppenheim was inclined to look on it with favor. Current opinion, however, seems to incline towards a primary degeneration of the posterior root fibers themselves, with possibly the implication of the ganglion cells as well. This is supported both by studies with the Bielchowsky method of staining the neurofibrils, and also by experiments on the effects of inoculation of dogs with Trypanosoma brucei by Spielmeyer. He was led to these experiments by the fact that the trypanosomes of the sleeping sickness really belong to the spirochetes and are closely related to the Spirochæta pallida. After from nine to ten weeks he found a selective process in the posterior roots, which was beginning to appear in the posterior columns, sensory trigeminus tract, and optic nerves.

The recent work of A. Marie and C. Levaditi appears to advance Spielmeyer's theory of selective action of Treponema pallidum in the development of paresis and tabes. After a review of well-confirmed in-

stances of paresis or tabes in husband and wife, in juvenile offspring of syphilitic parents, and the occurrence of both these diseases in from three to five individuals infected by the same prostitute, these authors claim to have accomplished at least three successive passages of Treponema pallidum in rabbits from the blood of a paretic. From an initial chancre they were able to carry successive inoculations through rabbits for several years. They point out important differences in behavior of virus from a chancre and of virus from the blood of a paretic as regards: (1) length of the incubation period from man to animal and from animal to animal; (2) the character of the lesions produced; (3) the susceptibility of other animals including man to infection from these animals; and (4) their immunizing properties. They conclude that there is a spirochete which causes cutaneous and visceral syphilis, and another which causes tabes and paresis; for these the terms dermotropic and neurotropic virus are suggested. The question, however, is still far from solution, and, even though the observations of the above-named authors be ultimately confirmed, one must admit that gross lesions of the vascular system are found just as frequently in neurosyphilis as in cutaneous and other visceral forms. To be sure this may be taken as further proof of Ehrmann's conclusion that the pathways leading from the initial lesion are the perivascular lymph spaces, and the endoneural lymph spaces; hence the vascular system would thus serve in the double capacity of host and conductor for both strains. The same might be said for the fact that during the initial or chancre stage a large number of individuals show definite increase of globulin and pleocytosis in the spinal fluid without other signs of organic lesion of the central nervous system. Even so, we are unable to explain why in the face of vigorous treatment sometimes neurosyphilis and sometimes cutaneous or visceral syphilis develops. As Heubner justly points out, it is difficult to speak of a virus specific to the nervous system when one finds gummatous syphilis in a paretic or tabetic subject.

The reaction of the individual not only to the parasite but also to treatment is in great need of further study and additional facts in this branch of the subject are needed to elucidate the whole question of pathogenesis. Surely it is from investigation along these lines that we may expect the answer to the question: Why do certain individuals live many years with unnoted syphilis before developing neurosyphilis? or, Why is neurosyphilis apt to develop in a shorter average time in treated than in untreated cases?

Course of the Disease.—Tabes dorsalis is usually a progressive disease up to the point of complete destruction of the posterior columns of the spinal cord, which coincides clinically with the complete uselessness of the patient for any purpose save as a manifestation of vitality. The course of the disease may be very slow, but, if untreated, each succeeding year usually finds the patient a little more incapacitated. Despite this

it should not be forgotten that, clinically, tabes is a recoverable disease. Unfortunately complete recovery does not often occur.

The clinical course of the disease is divided into: (1) a preataxic period, with its accompaniment of paresthesias, lancinating pains, disturbances in the urogenital sphere, and neurasthenic symptoms; (2) ataxic period, characterized by motor incoördination, loss of tendon jerks, objective sensory disturbance, hypotonia, and immobility of the pupil on exposure to light; and (3) a terminal stage attended by general muscular weakness and impairment of vegetative functions, in addition to the symptoms before mentioned, with the exception of pain, which, as a rule, completely leaves the patient in this stage. The duration of the disease is from ten years to half a lifetime. Certain cases terminate fatally within a few years, but it is very questionable whether these can be regarded as true tabes.

Diagnosis.—Ordinarily the diagnosis of tabes is not difficult; even in the earlier stages the presence of some of the signs—absent knee jerks, Argyll-Robertson pupils, lancinating pains, etc.—point positively to the nature of the disease. Formerly it was often very difficult to distinguish between tabes and polyneuritis, in which ataxia, absent reflexes, and lancinating pains were present, and the differentiation from diabetes complicated by neuritic manifestations was also very uncertain. These difficulties, however, have to a great extent been removed through our knowledge of the cerebrospinal fluid, and the Wassermann reaction. The spinal fluid should be subjected to at least four tests, namely: Wassermann reaction, cell count, globulin content and colloidal gold curve. In tabes the Wassermann reaction is positive in only 5 to 10 per cent if only 0.2 c.c. of fluid are used, whereas, it is positive in 100 per cent if larger quantities are used, that is, up to 2 c.c. The cell count is usually increased, but is not constant and may range from 8 to 200 cells per c.mm. More than this number should cause one to suspect an exudative type of cerebrospinal syphilis. The globulin is invariably increased and the colloidal gold curve is usually of the luetic type, or Zone II. Occasionally a true paretic curve will be found in a case which manifests evidence of tabes only. In this event our prognosis must be guarded, since there is always the possibility of a later paresis.

From the foregoing it will readily be seen that we have positive laboratory data which is a very valuable aid in diagnosticating tabes. In the case of polyneuritis or diabetes, we find the Wassermann reaction negative in blood unless syphilis be present adventitiously, and the fluid should be negative in all tests. We sometimes find difficulty in distinguishing between tabes or cerebrospinal lues and paresis. Tabes may be complicated by neurasthenic or emotional symptoms which simulate the early stages of paresis. Occasionally a cleverly assumed defense mechanism may be difficult to distinguish from a true euphoria, but in all instances

a period of careful observation will determine the presence or absence of typical mental changes and if these be supported by positive signs in the fluid and serum the diagnosis may eventually be established. Thus the Wassermann reaction in the serum and fluid of tabetics yields more readily to treatment than in paresis. The typical curve of the colloidal gold reaction, that is, the plateau type with sudden drops, is much more constant in paresis than in the other forms, and although this type, or Zone I as it is called, may be found in multiple sclerosis, lethargic encephalitis or tabes, it is much less constant and more readily influenced than in paresis. We have already mentioned the necessity of a guarded prognosis in every case of tabes in which a Zone I gold curve persists, especially if the physical signs be few and the mental symptoms indefinite. The positive Wassermann reaction does not seem to be affected, however, by any treatment whatever in general paresis, and it persists, as a rule, to the end. The lymphocyte count and globulin are most affected by treatment, the cells diminishing in number, and the globulin excess becoming normal.

The early diagnosis of tabes is most important, since a prompt recognition often means arrest of the morbid process, and hence the prevention of much misery for the patient. The only safeguard against errors of diagnosis is a most meticulous physical examination of every patient who has any of the recognized symptoms of the disease. The existence of one cardinal physical sign plus typical changes in the cerebrospinal fluid is, in our judgment, sufficient for a diagnosis. The Neurological Society of Paris about ten years ago discussed the occurrence of monosymptomatic tabes. The general sentiment was that, as there was no one pathognomonic sign, there could be no such type. Clinically this may be true, but the study of the cerebrospinal fluid has shown us that it is possible to have one symptom, either pains or Argyll-Robertson pupils, together with spinal fluid reaction indicative of tabes.

Occasionally cervical tabes presents difficulties of diagnosis. We may find knee and ankle jerks intact, no Romberg or bladder disturbances, but the Argyll-Robertson pupil is invariably present; lancinating pains in the arms and neck, anesthesias of the upper trunk, and absence of the reflexes of the upper extremities are the diagnostic points to be borne in mind. Déjerine has described conus tabes, in which for many years the only signs are anesthesia of the anus and perineum, loss of sphincter control, and sexual impotence.

Symptoms.—The symptoms of tabes vary greatly, and one might say that the clinical appearances of the disease are almost protean. In every case, however, there is always a group of symptoms and signs which, taken together, are quite distinctive. Two or three of them are invariably present in every case, and, as they constitute the earliest signs of the disease, they will be considered first. They consist of: (1) absence of tendon reflexes, that is, knee jerks and ankle jerks; (2) Argyll-Robertson pupil;

(3) Romberg's sign; (4) lancinating pains; (5) diminution or loss of cutaneous sensibility. These are the most constant of the earlier signs, but we frequently find a history of transitory diplopia or sudden loss of sexual power preceding the other symptoms by many years.

1. Absence of tendon reflexes, that is, knee jerks (Westphal's sign) and Achilles jerks, is the most constant sign of tabes, and is often present a long time before other signs appear. It varies greatly in the early stages, and may consist of inequality of the jerk, absence of one knee jerk with diminution of the other, absence of both ankle jerks with diminution of one knee jerk and no change in the other, or there may be alternation, that is, one knee jerk absent with retention of ankle jerk on the same side, while the opposite side shows absent ankle and present knee jerk. At first the knee jerks may be diminished to such a degree that they can be elicited by reinforcement only. This is known as Jendrássik's phenomenon, and consists in diverting the patient's attention to something else by having him pull his hands forcibly apart, counting aloud, coughing, or by having him recount his story. In testing the knee jerks it is important to have the quadriceps tendon relaxed and slightly stretched, either by having the patient sit with the knees crossed, the foot swinging free, or else by having him lie down while the examiner lifts the knee gently until it is partially flexed. A sharp blow is then struck over the patellar bursa with some blunt instrument. The Achilles jerks are best obtained by having the patient kneel on a soft cushion placed on a chair so that the weight rests on the knees alone, the feet protruding over the edge of the chair. If this is impracticable the patient may lie on his back with the thighs widely abducted and the legs partly flexed; the foot is firmly grasped and sufficiently dorsiflexed to slightly stretch the tendo achilles. Whenever this position is not satisfactory the patient may be placed in a prone position, the legs flexed and the foot dorsiflexed. Care must be taken in eliciting the ankle jerks not to strike the tendon at its insertion in the calf muscles, because if the muscle is struck a response will be obtained although the true tendon reflex may be absent.

2. The Argyll-Robertson pupil is almost as constant as Westphal's sign. It consists of loss of response to direct illumination with preservation of the pupillary contraction on convergence of the eyes gazing at a distant object. A complete loss of contraction to light is not invariably present, nor is it necessary for the determination of the phenomenon. Sometimes there is merely a sluggish contraction of the pupil, or it may respond only to strongly concentrated beams of light. The best method is to bring the patient close to a moderately well-lighted window and then shade the pupils with the hand. When the hand is quickly removed the pupil will contract promptly if the normal reaction is present. If the patient is in bed the test may be made with a lighted match, a candle, or a small pocket electric lamp. If the latter is used care must be taken

not to bring the light nearer than from 6 to 12 inches to the patient's eye. Sluggish or absent reaction has been noted in chronic alcoholism, chronic lead poisoning, meningitis and encephalitis lethargica. The shape of the pupils is likewise an important sign in tabes. In the majority of cases they are oval, pyriform, or otherwise irregular.

3. Romberg's sign consists of inability of the patient to stand securely with the feet close together when the eyes are closed. There is considerable discussion concerning the cause of this phenomenon, and the former view that it is due to blockings of impulses conveying the sense of attitude, that is, position sense, deep muscular sense, joint sense, etc., has been recently combated by Bonnier and others, who attribute the phenomenon to disease of the vestibular apparatus, or the labyrinth itself. That this is not always the case has been shown by Frenkel, Jacquod, and Förster in cases of extreme anesthesia of the soles. We may also find it in certain forms of peripheral neuritis of the lower extremities, such as chronic arsenical neuritis or alcoholism, where there are no evidences of vestibular disease. In some instances the swaying is so slight that we may be in doubt as to whether a true Romberg exists. We may then have the patient crouch or slowly sink to his feet, or have him stand on either foot alone. The uncertainty of station is always so conspicuous when a true Romberg exists that there can be no mistaking it.

4. Lancinating pains, lightning pains and electric or spot pains are most characteristic. They are frequently called rheumatic pains by the patients, and often treated as such by unobserving practitioners. They usually occur in paroxysms, are described as sharp jabs, knifelike in character, and rarely spread over large areas. They may be localized in one particular spot (spot pains), and occur at rhythmic intervals that almost completely demoralize the sufferer. They are frequently attended by cramplike contractions of the muscles and followed by great tenderness of the parts. The arms and legs are most often affected, and in some instances the intense pains will be limited to one single spot on any part of the limb, although the feet most usually are the seat of this particular form. Sometimes the girdle sensations may be accompanied by girdle pain which, when it occurs, is usually very severe. The groins also are favorite places for the appearance of these pains, whereas the trigeminus and upper cervical nerves are only occasionally affected. This, in view of the frequency with which the sensory root of the trigeminus is affected, seems strange. Very rarely the paroxysms are accompanied by temperature increase, vasomotor crises, local edema.

5. Anesthesia, analgesia, delayed sensation, and paresthesia are constantly seen early in the disease. Frequently analgesia or hypalgesia of the lower extremities with preservation of all other forms of cutaneous sensibility is seen, and in many instances it extends upward to the upper dorsal levels. The French school (Déjerine, Babinski, etc.) consider this

phenomenon of great diagnostic importance, however slight it may be. Déjerine considers it of diagnostic significance whenever the inner sides of the thighs and arms are less sensitive than the outer, since this is a reversal of the normal state. There are certain areas or zones in which these disturbances usually appear: the lower extremities, brachiomammary, urogenital, and cephalic zones. The sensory disturbances, on the other hand, may consist simply in delayed transmission of the impulse, so that from ten to fifteen or thirty seconds after the examining finger or instrument has been removed the patient perceives the touch. It is most frequently found in the lower limbs, and only very rarely in the arms or trunk. Paresthesias are very common and usually take the form of tingling, numbness, or burning sensations. They are found most frequently in three areas: the girdle sensation about the abdomen, the outer side of the calf and foot, and the ulnar distribution. Paresthesias of the trigeminus, tinnitus, tickling sensation in the larynx, have also been described. Pallesthesia, or loss of vibration sense in the long bones, pelvis, and cranium is often encountered, although this usually appears later. Loss of deep muscular sensibility also appears later, and only after the progress of the disease has become quite marked. It is characterized by the inability of the patient to recognize with closed eyes movements of joints executed passively, or to describe the attitude in which the limb has been passively placed. This can also be tested by having the patient simulate with one limb the attitude in which the other has been put, or by having him point at the great toe with the forefinger of the opposite hand and repeat this with the leg in various attitudes. It is absolutely essential for this test that the muscles of the limb examined be completely relaxed.

As the disease progresses, the ataxia begins to appear, and the patient realizes that there is difficulty of locomotion. This phenomenon usually appears insidiously at first, as a slight stumbling when walking over uneven surfaces or after stepping off or on curbs, a sudden giving way at the knees when walking down steps, and soon he realizes that it is necessary to watch the ground carefully while walking. The ataxia may never progress beyond this point, but in well-developed cases the gait becomes unsteady, staggering, slow, the heel planted down first or the whole foot slapped down in an awkward, ungraceful manner. In advanced stages it becomes impossible to walk without support. The more severe forms of ataxia are always accompanied by a marked degree of hypotonus of the muscles and tendons. This allows hyperextension or hyperflexion of the joints, contributes to the exaggerated joint excursions of the ataxic gait, and if not corrected tends to produce marked deformities of the knee and ankle joints. It may become so profound as to permit the most grotesque contortions, such as flexing the extended leg on the trunk until the feet meet behind the head, or extension of the leg until it forms an angle of 60° with the thigh.

Ataxia of the arm is rarely so well marked as in the legs, but betrays itself in the inability of the patient to perform delicate, coördinated acts, that is, writing, buttoning the clothes, drawing, etc. It can best be elicited by having the patient attempt to touch or grasp objects when the eyes are closed. When these movements are attempted they are performed awkwardly, and the finger, instead of attaining its goal with sureness, sways, runs by the object, and usually only reaches it by feeling about. Ataxia of the eye muscles is seen in the transitory diplopias that occur during the course of the disease.

Impairment of bladder function is almost constantly seen in well-developed cases. It may consist in difficulty in starting the stream so that pressure through the abdomen and diaphragm becomes necessary. There may be inability completely to empty the bladder through lowered tone of the vesical wall, or there may be sphincter hypotonus causing inability to hold normal amounts of urine in the bladder. On the other hand, there may be complete or partial incontinence as a result of anesthesia of the sphincter. The rectum may be similarly affected, but obstinate constipation is most frequent.

Of the cranial nerves the optic is most frequently affected in the form of bilateral simple atrophy, slowly progressive, which leads in many instances to complete amaurosis. The visual fields are usually concentrically contracted, but occasionally central scotomata are observed. Von Graefe reported bitemporal hemianopsia in a case of tabes, and we have also had a similar case under observation. The ocular muscles are frequently affected, but it is rarely permanent. The paralysis may affect the abducens or some of the branches of the oculomotor. A low degree of ptosis, which can be overcome by great effort, is often seen. The bilateral movements of the eyes are rarely paralyzed. The trigeminus is occasionally the seat of obstinate neuralgic pains. Corneal sensibility is usually diminished, whereas the cutaneous distribution of the nerve is rarely affected. Disturbances of a trophic nature are sometimes associated with the trigeminus affection; falling of teeth (Oppenheim), spontaneous fracture of alveolar process, lacrimation, hemiatrophy of the face have been described. Marie has described atrophy of the masseters. The acoustic is also occasionally affected, causing deafness and tinnitus. Neuralgic pains in the canal may occur. The hypoglossal nerve sometimes becomes affected, and hemiatrophy of the tongue results.

The affections of the vagoglossopharyngeus are so intimately associated with the crises that they will be considered together. The crises belong to the visceral disturbances of tabes, and consist in paroxysmal cramplike affections of the viscera, with or without pain. The most common are gastric crises, which occur as sudden spasmodic contractions of the stomach, causing nausea or vomiting. They usually appear without the least warning, have no attributable cause, last from a few hours

to many days, and then disappear as suddenly as they came. During the attack very little can be retained by the stomach, and sudden alarming loss in weight is sometimes seen. During the intervals between the attacks the stomach behavior is usually quite normal, and digestion unimpaired. If the attack is severe hematemesis may result. Premonitory symptoms, such as hallucinations of taste and smell, epigastric paresthesias, or pain in the neck, have been described. Intestinal crises occur, but they are more rare, much less painful, and are characterized by sudden uncontrollable evacuations of large mushy stools. Laryngeal crises are much less frequent than gastric crises. They are really attacks of spasmodic coughing accompanied by a distressing sense of tickling and sometimes by other vague crises, such as tachycardia, dyspnea, and sense of oppression over the precordial region. Vesical and rectal crises, that is, painful spasms of bladder and rectum with sudden emptying of their contents, are also an occasional manifestation of the disorder. Pharyngeal crises have also been reported (Oppenheim, Bechterew).

The trophic disturbances of tabes consist of muscular atrophy, arthropathies, ulcerations, alteration of skin and its appendages, and vasomotor disturbances. The atrophy of tabes may be due to simple wasting from disuse, wasting due to disease of the peripheral nerves, or it may result from disease of the anterior horn cells. The isolated atrophies, hemiatrophy of the tongue, atrophy of a single muscle, are very likely neuritic in origin, but one or both limbs are often affected in the same way. It is to be recognized by the hard, dense sensation the palpated muscle offers to the touch, and resembles other forms of neuritis.

Atrophy of central origin has been described and confirmed by histologic examination by Déjerine, Shaffer, and one of us. As Déjerine rightly says, it resembles a combination of tabes and chronic anterior poliomyelitis.

In connection with the atrophies of the lower limbs, Joffroy has described an interesting deformity of the foot called "Pied Bot," which is a pronounced pes cavus in which the toes are flexed, the arch of the foot much accentuated, and the long axis is greatly shortened.

The most striking trophic disturbances are the arthropathies. They were first described in their proper relation to the disease by Charcot, and although still prevalent they are certainly far less frequent than they were fifteen or twenty years ago. The early recognition of the disease, the prompt inauguration of treatment, and the various methods for the prevention and correction of hyperextension have undoubtedly contributed towards reducing the number of these deformities. They have been found in almost every joint in the body, but occur most frequently in the knees. Suddenly and without any warning the joint tissues begin to swell. The parts become hard, non-fluctuating, painless, as a rule, without temperature, and often reach an enormous size. As the condition progresses the

cartilaginous portions are also affected, and then the head of the bone. These are then absorbed, and the rough ends of the bones, being left in apposition, can be distinctly felt grating on movement. In other words, subluxation occurs. The knees and ankles are most often affected, but such arthropathy has also been described in the arms, shoulders, hips, mandible and vertebral column as well. The arthropathies are frequently accompanied by abnormal brittleness of the long bones, and spontaneous fracture may occur. Not all the arthropathies are as severe as the above description, however, and a form frequently occurs which yields to treatment and disappears completely. Trauma very often plays an important part in the production of these lesions, but usually no history of this can be obtained. Sometimes the reactions about the fragments of a fracture are so violent as to produce a condition similar to an arthropathy. We have seen this in one of our cases, a tabetic who developed an arthropathy of the ankle joint following an operation on a perforating ulcer of the sole. During his convalescence he struck the back of the right hand a sharp blow, felt no immediate discomfort, but noticed two days afterward a swelling on the back of the hand the size of a large walnut. Examination showed he had fractured the third metacarpal bone in its middle third. Strange to say, he made a complete recovery, the fragments uniting perfectly. Usually, however, the fragments unite with the production of enormous callosities and deformities.

The cutaneous trophic disturbances are represented chiefly by the perforating ulcer, "mal perforant" of the French. It is found usually in the plantar surface at the metatarsophalangeal articulation, but sometimes attacks the hands. The French have also described a perforating ulcer of the buccal cavity. It is always quite painless, usually begins with the formation of a vesicle, which soon breaks down and leaves a round, punched-out, dry ulcer. It progresses inward if left alone, involving bones and perforating the foot completely. Other cutaneous disturbances are local edemas, falling of hair, nails, etc., erythemas, and purpuric spots.

Treatment.—Success in the treatment of locomotor ataxia has kept pace with the development of knowledge of the nature and cause of the disease. Though usually regarded as incurable, persistent methodical treatment does more to stay the development of the pathological process and to prolong the time of the victim's usefulness than in any other organic systemic disease of the nervous system. Haphazard, casual, unmethodical treatment should have no place in the handling of tabes. The treatment of the disease may for convenience sake be considered under five heads:

1. Treatment of the attributed factors of its causation.
2. Treatment of the morbid process forming its anatomical basis.
3. Treatment of distressing symptoms due to the disease.

4. Treatment having for its aim reëducation of the extremities.
5. The general systemic treatment, and plan of treatment.

Causal Therapy—Advisability of Antisyphilitic Treatment.—Syphilis is the only causative factor of tabes that will be considered here, as the other attributed factors are discussed under general hygiene. Neurologists have not agreed as to the advisability of giving antisyphilitic treatment in cases of tabes. Some have steadfastly held that such treatment is useless in every case of true tabes, no matter how clear a history of previous luetic infection the patient gives or how indifferently he may have been treated during the active period of the syphilitic poison, providing, of course, that the symptom-complex of tabes did not develop within a short time after the syphilitic infection, from two to four years. On the other hand, modern therapy teaches that every case of tabes giving a syphilitic history should be put through a rigorous course of antisyphilitic medication, combined with general restorative treatment, if there are no apparent objections to such procedure, and providing the patient has not already received such treatment at the hands of another physician. No hard-and-fast directions can be given for the guidance of the beginner who faces this question for the first time.

The study of cerebrospinal fluid furnishes us important indications for the use of antisyphilitic remedies, and at present we are guided by this alone. If it is not possible to have the fluid competently examined, every patient who develops tabes within ten years after the initial lesion, or who shows unmistakable evidences of an active progress in the disease, should be immediately subjected to vigorous treatment. These evidences are: persistent pains, extension of pains to new areas, development of crises, or rapid development of paralytic phenomena. A high cell count in the cerebrospinal fluid and excess globulin mean activity in tissue lesions, and they should be treated in the same way until this disappears. The time is too soon as yet to say whether a cell count that has yielded to treatment and approached the normal limits may increase at a later period. At all events, it is important to control these cases by lumbar puncture at stated intervals, and treat them accordingly if the cell count rises. It is just as well to disregard the Wassermann reaction in the serum or fluid, since it may persist even after the most vigorous treatment.

The selection of the remedy has been greatly modified by the addition of arsphenamin to our pharmacal armamentarium.

Its value as a therapeutic agent can no longer be questioned. When combined with mercury it is the most important agent we possess for the treatment of all syphilitic diseases of the nervous system. Within the past few years the original arsphenamin has been more or less replaced by neo-arsphenamin and silver arsphenamin. The former has the advantage of being properly neutralized and therefore requires no further neutraliza-

tion with sodium hydroxid before injection. Silver arsphenamin has been only recently introduced and accurate information concerning its full value is not yet at hand. The arsenic preparations are at present administered by two principal methods, the relative merits of which are still the subject of considerable discussion. They may be termed intravenous and intraspinous, which, as the terms imply, indicate the two main avenues whereby the drug is introduced into the system.

If intravenous therapy be selected arsphenamin, neo-arsphenamin or silver arsphenamin may be used, and of these the choice at present seems to fall upon neo-arsphenamin because of its standardized neutralization through which the personal factor in the neutralization of the older salt is eliminated. Certain it is that since the introduction of this form the frequency of bad systemic reactions and the signs of local irritation of the gastro-intestinal mucosa, such as vomiting, cramps, diarrhea, severe chills, etc., have been very greatly diminished. Larger doses are more easily tolerated and therefore it can be given more intensively. The initial dose should be small, not more than from 0.3 to 0.4 gm., in order that the tolerance may be determined and subsequently increased to 0.7 gm. The second dose may be given after an interval of five days, but subsequent doses are best repeated at weekly intervals. Schamberg, Klauder and others recommend the full dose of 0.9 gm., but in our experience the full dose is not well borne by the average patient and we believe it wiser in routine practice to make 0.7 gm. the maximum dose. During a course of neo-arsphenamine treatment, the utmost care must be exercised to supervise the renal and intestinal function. The urine should be examined at frequent intervals for evidence of irritation, and an occasional examination of the stools for mucus is also wise. Schamberg and Klauder consider the appearance of paresthesias beginning in the feet and extending upward throughout the legs, loss of weight and a continuous feeling of malaise as indicative of a developing intolerance for the drug, which must be combated by temporary cessation of its use. Whether or not these signs are due to an insidiously developing arsenical neuritis or are merely expressions of intestinal irritation is uncertain. However, it has been our experience that after withdrawal of the arsenic the individual is more quickly restored to his former state of well-being if the diet is carefully regulated and a few intestinal irrigations are taken. If arsphenamin is chosen it should be administered in from 0.3 to 0.4-gm. doses. The technical difficulties of administration of this drug are much greater than neo-arsphenamin because of the necessity for proper neutralization with sodium hydroxid before injection. Silver arsphenamin, a combination of neutralized arsphenamin with one of the organic silver salts, is still in the trying-out process and we are unable to state with certainty what advantages in therapeutic effect it may have over the other salts or what disadvantages it may possess. Thus far in our own experi-

ence it seems less toxic than the other salts and is well tolerated by individuals in whom even neo-arsphenamin causes severe reactions.

The intraspinous method, which consists in the injection into the subarachnoid space of either salt solution, serum, mercury, or salvarsan or else simple drainage, has undergone several technical modifications and thus offers a greater variety of choice than the intravenous method. The reason for this is perfectly obvious and is due: (1) to the totally opposing views about the value of any sort of intraspinal therapy; and (2) to a disappointing lack of uniformity of results by any one method. The pioneer work in this field was done chiefly by Ravaut, Marinesco, Wechselmann and others. Their results, especially those of Ravaut, of the injection of arsphenamin dissolved in normal saline were so unfortunate that they were quickly abandoned.

The popular method in this country is known as the Swift-Ellis method and consists in the direct injection of inactivated serum containing arsphenamin, previously administered intravenously, into the subdural space.

This technic, at first cumbrous and time-consuming, has been simplified so that at present it is as follows: fifteen minutes to one hour after the administration of arsphenamin 0.4 gm., 25 to 40 c.c. of blood are withdrawn and allowed to clot. The serum is carefully freed from hemolytic elements and inactivated. A volume of spinal fluid equal to the amount of serum to be injected is then withdrawn and to the needle in situ a large Luer syringe is attached by means of a rubber tube, 30 c.c. of fluid are allowed to flow into the syringe and serum is added. The mixture is gently agitated and reinjected slowly into the subarachnoid space. Swift found that in a majority of cases 1 c.c. of serum one hour after intravenous arsphenamin contained 0.01 mg. of the arsenic.

Ogilvie modified the Swift-Ellis method by adding arsphenamin directly to the serum. He emphasized the uncertainty of the dosage, which must necessarily vary according to the length of time elapsed between the intravenous injection and the withdrawal of blood. His claim is that by his method the dose of arsphenamin can be controlled with absolute certainty, and he recommends the following technic: to 15 c.c. of serum clarified by high speed centrifugalization, that is, at least 3,000 revolutions per minute for fifteen minutes, the requisite amount of arsphenamin dissolved in distilled water just as for intravenous use is added. The arsphenamin solution should be diluted so that each 40 c.c. contains 1.0 dg. of arsphenamin, that is, 2.5 mg. to each cubic centimeter. Care should be taken that the solution be only faintly alkaline and the sodium hydroxid should be added quickly, not drop by drop. The solution can then be added to the serum by means of a 1 c.c. pipet graduated in tenths. The temperature of the arsphenamin and the serum should be the same when mixed. The container is gently agitated, placed in a thermostat at 37° C. for thirty-five minutes, then in a thermostat at 56° C. for thirty

minutes. It should be used as soon after this as possible, and under no circumstances after the lapse of three hours. The dose of arsphenamin is from 0.2 to 0.5 mg. We consider this the maximum dose and rarely give over 0.3 mg.

A combination of the Swift-Ellis and Ogilvie methods is practiced by some and, as may readily be inferred, consists in the reinforcement of serum containing arsphenamin given intravenously by the addition of arsphenamin according to the Ogilvie method.

Byrne has strongly advocated the use of mercurialized serum which is prepared by adding from 1.3 to 2.6 mg. of mercuric chlorid to 12 c.c. of human serum, diluting the mixture with 18 c.c. of normal saline and inactivating at 56° C. After the needle is inserted an amount of spinal fluid is withdrawn equal to that of the serum, which is then injected.

Injection of simple human serum or normal saline is sometimes employed. The serum should always be free of fibrin and corpuscles and must be inactivated at 56° C. for one-half hour. This procedure, according to Nehrtins and MacArthur, should always be followed several hours later by intravenous arsphenamin.

Still another method is that of spinal drainage, which consists in withdrawing, immediately after intravenous administration of arsphenamin, as much spinal fluid as can be obtained without causing discomfort to the patient. It may be performed once in ten days or even once a week. Puncture must always be performed with the patient lying on either side, because of the relatively large amounts of fluid withdrawn. Just as much care in differential diagnosis is necessary, if not more so than in any other method of intraspinous therapy.

There is still a wide variance of opinion concerning the relative merits of the different methods of intraspinous therapy; in fact, the absolute value of any form of intraspinous therapy is still far from established. There are many enthusiastic believers in the efficacy of the Swift-Ellis, the Ogilvie, the combined Swift-Ellis-Ogilvie, the Byrne and the spinal drainage methods, especially among the self-constituted, so-called neurosyphilographers; but we feel that the dangers of these methods, the severe, often prolonged, violent reactions, the many unfortunate, nay often disastrous results following the first four of these procedures demand the utmost care and deliberation before undertaking this special course of therapy. The careful student is likewise confronted with the difficulty that we are still in the dark concerning the actual rationale of these methods. It is well known that intraspinous therapy suggested itself because of the fact that, after ordinary intravenous administration, arsenic is found in the spinal fluid in only a limited number of cases, while the percentage of positive findings is greatly increased if the spinal vessels be dilated and congested by simple lumbar puncture or irritated by the introduction of the patient's own serum into the subarachnoid space. The

deductions from these facts are that, either by lowered cerebrospinal pressure, congestion of the vessels or irritation, the permeability of the choroid villi is greatly increased, allowing the passage of greater amounts of arsenic into the fluid. On the other hand, the value of adding either arsenic or mercury directly to the subarachnoid space becomes very doubtful in view of the rapidity of its removal through the arachnoidal villi and dural circulation as demonstrated by Solomon and Rieger, Hall and others; again through the recent experiments of Weston which appear to show that although the rate of excretion by the kidneys of phenolsulphonephthalein when introduced into the lumbar levels varies in different diseases, even after five-hour intervals it cannot be recovered from the cisterna magna. Even Schamberg and Klauder admit that probably the sole explanation of the value of intraspinous therapy lies in the theory of increased permeability of the choroidal villi resulting from the meningeal irritation which homologous or heterologous serum causes when introduced into the subarachnoid space.

Our experience has taught us that, in spite of its popularity, the intraspinous administration of arsenic affords in ordinary routine practice no better therapeutic results than the drainage method. On the contrary, even in the most skillful hands it is fraught with possibilities for unfortunate sequelæ, not the least common of which is a severe obstinate rectal and vesical incontinence that may persist for years. The results of spinal drainage in a carefully selected group of cases from our clinic have been admirably summed up by Craig and Chaney as follows:

"1. No single method of treatment is applicable to all cases.

"2. The intravenous administration of arsphenamin is the method of choice.

"3. Spinal drainage after intravenous administration of arsphenamin is not a hazardous procedure.

"4. Drainage will benefit some cases which have arrived at a period of inertia under intravenous therapy.

"5. As satisfactory clinical and serological results may be obtained by intravenous arsphenamin and drainage as are produced by the intraspinous method, and without the severe root pains frequently set up by this latter method."

Our feeling is that the intraspinous administration of arsphenamin for the reasons just mentioned in the preceding paragraphs should never be employed as a routine practice, but only in cases where all other means have failed to relieve a condition of intolerable suffering. Occasionally cases are seen in which all active processes have subsided, leaving as a residue obstinate gastric crises or paroxysms of lancinating pain which defy all ordinary remedial measures, render the unfortunate sufferers at least potential habitués, and sometimes reduce them to a state of emaci-

ation, exhaustion and complete demoralization. As a means of last resort intraspinous arsphenamin by the combined Swift-Ellis-Ogilvie method by reason of the violent reactions may give astounding relief. This occurs we believe through the action of the serum as a strong counter-irritant which relieves congestion of sclerotic roots or in some way stimulates leukocytic activity to prevent the contraction of root sheaths. This method should always be tried before surgical interference is advocated for the relief of crises, although the possibilities of unfortunate sequelæ must always be kept in mind.

If it is decided to put the patient upon a mercurial course of treatment, our experience has been that the best results are obtained by inunctions. If this method cannot be adopted, it may be given hypodermatically. When it is decided to give the patient a course of mercury, one should enter upon it in no half-hearted way. From gr. xxx to xc of blue ointment should be rubbed in daily, each rubbing lasting at least from twenty to thirty minutes, and the course kept up from four to six weeks. If hypodermatic injections are given, they should be administered either as bichlorid of mercury, beginning with gr. 1/20 and increasing until either gr. 1/4 or gr. 1/2 are given every day, or salicylate of mercury suspended in liquid albolene in doses of 1 to 2 gr. once a week. In either case it had best be given deep in the gluteal muscles, and high enough not to interfere with the patient's comfort while sitting.

Treatment Directed against the Morbid Process.—Innumerable measures have been suggested to counteract the progress of the morbid conditions forming the basis of locomotor ataxia. The truth is that there are no substances which experience has shown to have any effect in delaying the disintegration of the sensory neuron, although iodid of potassium is still popular. The most common experience that we have is to find that patients with tabes have been treated by giving them great quantities of iodid of potassium, often in large doses. We desire to say emphatically that we have never seen anything but injury result from such therapy, and to deprecate its use. The iodids are not antisyphilitic agencies in the true sense of the term. They may, indeed, and often do, facilitate the dispersal of a syphilitic lesion when it is of an exudative nature, but never when it is of a degenerative nature primarily. Farnell has urged the combination of large doses of sodium iodid intravenously in conjunction with the arsenic preparations on the ground that by means of proper ionization of the tissues a more receptive medium for the absorption of arsenic is prepared. We have never seen the slightest benefit result from the administration of ergot, which, on the recommendation of Charcot and Hammond, achieved a reputation wholly undeserved. It should never be given. Strychnin and the glycerophosphates are extensively and deservedly used, but not with any view to influence the anatomical lesion of the disease, save by improving the general nutrition.

Symptomatic Treatment.—In meeting the indications of the third caption, the physician will have abundant opportunity to display his therapeutic resources. The pressing claims are the relief of the lancinating pains. These may be so severe and so unyielding to every form of therapy that they demand the administration of opium or one of its alkaloids, but this should in every instance be kept as a last resource. Usually the pains can be ameliorated by the use of the coal-tar derivatives, such as phenacetin, antipyrin, acetanilid, or by combinations of these with alkalis, such as antifebrin, and by counterirritation over the spine, such as by the actual cautery applied very lightly from the nape of the neck to the lower lumbar region, by spinal stretching and suspension, electricity, warm baths, and the application of pungent soothing medicaments to the skin.

The combinations of the analgesics which we find most serviceable are:

℞ Caffein. salicylatis gr. i (0.065 gm.)
Phenyl salicylatis gr. xv (1.0 gm.)
Phenacetin gr. x (0.60 gm.)
One powder to be given every two hours until pain is relieved.

If the pain occurs at night, and the caffein seems to increase the wakefulness, we employ the following prescription:

℞ Phenacetin gr. x (0.60 gm.)
S. Dissolve in hot water and administer conjointly with chloralamid, in powder or elixir form.

Pyramidon in doses of from 1½ to 5 gr. is sometimes efficacious; dionin, gr 1/3, has also been recommended.

In a similar way the analgesics may be combined with sulphonal, trional, medinal or luminal. Occasionally the pain can be relieved by the prolonged warm bath (temperature 98° to 102° F.), lasting from fifteen minutes to half an hour, and general faradization of the extremities. Rarely, wrapping the legs or thighs in flannel wrung out of hot water in which capsicum has been dissolved, or moistened with chloroform and ether, is of service. No benefit to the pain is obtained from massage, mechanical vibration, or percussion of the nerve trunks, nor from the application of a spray of ethyl chlorid to the vertebral column. On the other hand, material relief may attend the application of dry cups to the spine, the use of the actual cautery, and of stretching. When all other measures fail to relieve, it becomes necessary to benumb the sensorium by the use of opium. In full knowledge of the danger to the patient who receives morphin for the relief of pain which is sure to return, the physician is nevertheless under moral obligation to his patient to make use of this measure in certain cases; but he who leaves a syringe with the patient or with one of the family to be used when the pain is unbearable, outrages

the privilege conferred on him by the Hippocratic oath. Even though the patient may live in the country far removed from his physician, no shadow of justification exists for making him a morphin habitué.

Treatment of the various crises that sometimes occur in tabes usually demands the temporary use of morphin, and the fact that the stomach is disordered in its functions in the most common of these crises makes it necessary that it be used hypodermatically. There is no danger of the formation of the morphin habit, for just as soon as the crisis is over there is no further indication for its use. If the gastric crisis is of only slight intensity, a temporizing measure of some satisfactoriness is the oxalate of cerium, given in from gr. iij to x doses, in the form of either a pill or wafer. Its efficacy may be materially enhanced by combining it with gr. 1/6 of cocain. During and following gastric crises of tabes there are marked deviation of the degree of acidity of the stomach and falling off of the peptogenic properties of its secretions; and one must be guided by the condition of hyperacidity or hypoacidity which is present in the vomit in reaching a decision as to medication and alimentation at this time. While the crises last the patient must be fed by nutrient enemata. In gastric crises considerable relief is sometimes had by the intermittent application of ice over the stomach, spraying the epigastric region with chlorid of ethyl, and by touching the skin of the epigastrium with a glowing iron. Prolonged faradization of the abdominal wall has likewise seemed to me of service in a few instances. Vesical crises demand the administration of morphin to allay the overpowering distress in the beginning. After this the patient can usually be kept in a comfortable state, until the crisis ceases, by the giving of a mixture of chloral hydrate, fluid extract of belladonna, and fluid extract of hydrastis. Laryngeal crises frequently require inhalation of chloroform, but never up to the point of complete narcosis. As in other crises, the two most reliable measures are morphin and absolute quiet.

Injections of stovain, novocain, and fibrolysin into the spinal canal have been recommended by Pope, Secord, L'Hermitte, and others. Pope saw wonderful improvement after four injections of fibrolysin. The reflexes returned, gait improved, pains and paresthesia disappeared, and the patients were in every way astonishingly better! L'Hermitte saw a similar result. It would be interesting to hear how these patients were a year after treatment. Suffice it to say the method has not found favor as yet.

Long after the active progress of the disease has been checked, the lightning pains and crises may reappear at irregular intervals. In many instances this is probably the result of toxic irritating substances emanating from the intestinal tract or the liver. They are best treated from the start by vigorous catharsis and some of the so-called intestinal antiseptics. At the onset of the attack we prefer to give an ounce of castor oil, and

then keep the patient on a low, non-fermentative diet. Intestinal or gastric crises will often improve astonishingly on 10-drop doses of castor oil combined with 5 gr. salol, and repeated every two hours. If all other measures fail, frequent and thorough drainage or the intraspinous injection of arsphenamized serum should be resorted to. Dangerous though the latter may be, anything should be tried to prevent the formation of the drug habit. Extreme care must be observed and the dose employed should never exceed 2 mg.

Retention and incontinence of urine frequently call for special medication and handling, aside from the direct mechanical treatment, such as regular catheterization, washing out the bladder with sterile water, or water to which some alkali or antiseptic has been added. Some preparation of belladonna or hyoscyamus with fluid extract of hydrastis canadensis or ergot may be given internally with good results, and, naturally, urotropin must be given freely. At the same time the bladder should be galvanized through the abdominal walls in the following way: One large electrode, 6 by 12 cm., should be placed above the symphysis, and the other electrode of half the size and with a concavity so that it fits up close beneath the pubic arch, then a current of from 10 to 20 m.a. allowed to flow through from three to five minutes. In some cases the mixed current, the galvanofaradic, seems to act more satisfactorily than the galvanic current alone. This expedient is often of considerable service both temporary and permanent. When the incontinence of urine becomes complete, it is necessary for the patient to wear a rubber urinal, and to have the bladder washed out once a day.

Surgical measures for the relief of pains and gastric crises have been employed with somewhat uncertain success. The older abdominal operations were always unsuccessful, and usually left the patients worse off than before. Within the last few years there has been great activity in intraspinal surgery, and intradural incision of the posterior roots corresponding to the painful areas has been done. It is a dangerous procedure, however, and should only be undertaken as a measure of last resort. In the first place, they are not always successful, fully half the number have had no relief, and, besides, we are taxing an already weakened organism. It is well known that tabetic patients do not withstand operations as well as other individuals.

Tabetic amaurosis is one of the saddest, and fortunately one of the more infrequent manifestations of tabes that call for individual medication in addition to that undertaken for the amelioration of the disease itself. A most astonishing occurrence, and one which cannot be explained, is that all tabetic manifestations occasionally cease when the amaurosis becomes complete. There is no measure that can be depended upon to influence the amaurosis, yet occasionally the injection of sulphate of strychnin does good, and it should in every instance be tried, beginning

with gr. 1/100 and increasing it every day until the physiological action is plainly manifest. Iodid of potassium should never be given in these cases, for unquestionably such administration hastens the process in the optic nerves. In this connection we desire to say that we do not consider an impending tabetic amaurosis a contra-indication to the use of arsphenamin.

In the terminal stage of tabes there is great liability to the formation of bed-sores over those parts of the body that have been subjected to continual pressure, and all possible care should be taken to maintain the nutrition of the skin and subcutaneous tissue of these parts, as it is very much easier to prevent their occurrence than to cure them. Attention directed to the texture, evenness, and covering of the mattress; a daily cleansing bath and frequent sponging with cold water and alcohol; attention to the state of the bowels and bladder, will usually prevent the occurrence of bed-sores. If they occur despite these, they must be treated according to the requirements of modern aseptic surgery.

It is not necessary to speak in detail of the treatment of such conditions as perforating ulcer, tabic arthropathy, and the osteopathies that may occur. In addition to the general treatment of tabes, they require the same surgical and orthopedic measures that trophic troubles of different origin demand. Immobilization of the joint is the essential thing. The perforating ulcer is often extremely resistant to all forms of treatment, and occasionally it progresses to such a degree and is so associated with adjacent profound arthropathy that it requires amputation; but this, fortunately, is very exceptional. Hyperextension of the knees also occasionally calls for orthopedic appliances.

General Treatment.—In latter years the measures that physicians have come to rely upon more and more in the treatment of tabes are those that may be included under the head of physical treatment, including hydrotherapy, balneotherapy, electrotherapy, massage, purposeful movements, suspension, and rest.

As in most other chronic diseases of the nervous system, hydrotherapy is a valuable agent in tabes to improve the patient's nutrition and to maintain his strength. The special hydriatic procedure that should be used in a given case depends largely on the patient, his idiosyncrasies, and his reaction to water at different degrees of temperature, but not a little on the symptomatic variety of the disease also. It is of far greater service in the cases attended by marked hypotonia than in the sensory forms. The usefulness of the warm full bath to relieve the shooting pains and the muscular soreness following an accession of the pains has already been spoken of. If given oftener than three times a week, it has a relaxing effect which should be avoided. In many cases, and especially those in which the pain is not very severe, the half-bath, temperature from 85° to 75° F., of from two to five minutes' duration, with

friction, given every day, is followed by a general gain in bodily vigor, renewed feeling of well-being, and improvement of nutrition. When cutaneous stimulation or irritation seems advisable, salt, pine-needle extract, or a stream of carbon dioxid gas may be added to the water. As a rule, however, very little is gained by these procedures. The thermal element is the important factor, and to this are owing the good effects of a sojourn at many watering places. Strong, full-blooded patients who react promptly and with pleasant subjective sensations to the application of cold water, often find much benefit from the use of water of 70° to 65° F., given from the hollow hand of an attendant, accompanied and followed by vigorous friction, and from the use of a tonic bath according to the following formula: hot-box until mild perspiration results; Charcot douche, temperature 90° F., reduced daily from 2 to 5° until 65° F. is reached, pressure ten to twenty pounds, duration thirty to sixty seconds, applied to the back, chest, abdomen, and calves, and followed by a Fleury spray, temperature 65° to 75° F., pressure fifteen to twenty pounds, duration fifteen seconds, followed by light friction all over the body for from two to five minutes, depending on the patient's reaction, and a brisk walk in the open air.

When it is impossible to send the patient to a hydriatic institute, this procedure may be replaced by wrapping the patient in a dry, hot blanket for from ten to thirty minutes, giving him a hot drink, water, weak tea, or milk, if his digestive apparatus is in good condition; then when the cutaneous circulation, especially that of the extremities, shows the effects of this internal and external heat, water is forcibly thrown from a dipper upon the spine and over the abdomen and chest, or the patient is flagellated briskly and quickly with the ends of a towel dripping with cold water, and followed by friction.

Urogenital symptoms are often benefited by the use of cool sitz baths, temperature 75° F., duration two to five minutes. Many patients object to them because of the idea that it increases the pain, but nevertheless such a bath is often serviceable in stimulating a distended atonic bladder to empty itself. Some writers recommend for the relief of pain and for its general tonic properties the use of a cold wet pack, which, of course, becomes warm after it has been in apposition with the body for a short time. It is said that the uniform warmth thus induced tends to mitigate pain and dissipate paresthesia. We have not seen much benefit from it.

Many patients with tabes are greatly improved by a sojourn of a few weeks, once or twice a year, at the thermal mineral springs of this country, and the rôle of balneotherapeutics (mineral water treatment in contradistinction to hydrotherapeutics, the external or internal use of plain water) in the treatment of tabes is an assured and an important one. In this country the hot springs of Virginia and Richfield Springs are the

most important. In Germany, those of Oeynhausen and Nauheim; and in France, those of Lamalou and Balaruc are in best repute. The manner and method of using the warm salt baths are very important, but usually it is necessary, when patients are recommended to visit a certain spring, to leave this matter to the physician of the baths. Nowadays it is almost unknown for a patient to take a course of waters at any of the springs without first putting himself in the care of one of the many physicians who are to be found there.

Tabetic patients are also often benefited, especially if they are anemic, dyspeptic, and inclined to cachexia, by a short visit to one of the many medicinal springs in this country and in Europe, such as Poland Springs, Ragatz, St. Moritz. The regulation of diet and of exercise, the open-air existence, and the devotion of a proper number of hours to sleep, which are the usual entailments of such places, all help to improve the patient's nutrition, to husband his energies, and to increase his strength.

The Use of Electricity in Tabes Dorsalis.—Almost from the time when tabes was first recognized as an individual disease, electricity has been accorded an important place in its treatment. Duchenne and Remak set the example in Europe, and they soon had innumerable followers all over the civilized world. It is quite impossible to estimate accurately what service it really renders in this direction, but it matters not whether its usefulness is due to suggestion or to some possible influence in counteracting the process of decay in the posterior columns of the cord; so long as it helps to prolong the patient's life and makes it more livable it is deserving of employment. Electricity is utilized in tabes by application of the galvanic current directly to the spine; the galvanic and faradic currents to the peripheral parts, including the cervical sympathetic nerves, and as static electricity. Of all the procedures, galvanization of the spine is the most important. Many modes of applying it have been recommended. The two following methods are quite satisfactory: the negative pole connected with a large electrode (6 inches square) is placed on the chest, and the positive pole connected with a smaller electrode (1 to 2 inches square) on the spine, and moved slowly from the cervical to the sacral region, the current from 6 to 10 m.a., the duration of the treatment being about ten minutes. This should be done daily, and in very few cases it is more satisfactory if the electricity is applied twice a day, each séance being of from five to ten minutes' duration. It is highly probable that the beneficial effect of electricity thus applied is commensurate improvement of the circulation of blood and lymph through the posterior columns, nerve roots, and adjacent tissue. The other method is to place the cathode firmly over the superior cervical ganglion at the angle of the lower jaw, the anode over the opposite side of the spinal column, close to the spinous processes, and allow a current of 4 m.a. to pass. The positive pole is then rubbed up and down the spine for about five minutes on one side, then the cathode is

changed to the cervical ganglion of the other side, and the same procedure used for the opposite half of the spinal column. In this way the posterior roots and the intervertebral ganglia are stimulated, and, in view of the important part taken by disease of these structures in the pathogenesis of tabes, it can readily be seen that this is a desirable operation.

Some amelioration of the paresthesia may confidently be expected from the use of faradic electricity applied to the skin of the extremities. Greatest excitation of the cutaneous nerves is obtained by using the small brush electrode. If it is desired to stimulate the peripheral neuromuscular apparatus, either the faradic or the galvanic current may be employed. When it is elected to use the latter, the positive pole should be used as the differentiating electrode. It need scarcely be said that electrical treatment should not be relied upon exclusively. On the contrary, it should be looked upon as an adjuvant of importance, and given in connection with other physical and medicinal treatment. Its effects seem to be best when it is given for a period of six weeks three or four times a year.

In certain cases of tabes the regular, persistent use of massage is very beneficial. At least it gives more comfort than almost any other measure. It is especially useful in cases of long duration. It counteracts muscular hypotonia and asthenia in a more gratifying way than any other measure, and the symptom described as "giving way of the knees" will often disappear under this form of treatment. Vigorous kneading and compression of the back often decrease the girdle sensation, while general massage may be used for its tonic effects. Stretching of the peripheral nerves either by operation or by the bloodless method, which formerly had considerable vogue, is to be condemned. No doubt such procedure sometimes relieves pain, but the same results can be obtained by having the patient lie on the back with the head slightly elevated and the legs extended; an attendant then grasps the feet and draws them back toward the patient's head, the knees remaining extended. This position is maintained for from two to four minutes, and repeated once or twice a day. Suspension was recommended by Motschutkowsky in 1883. In the decade following neurologists of every nationality testified to its efficacy in ameliorating the symptoms of tabes, and apparently in modifying the course of the disease. During the past few years very little has been heard of it, and its use has been generally discontinued.

Reëducation of the Ataxic Extremities, Fraenkel's Method.—Difficulty of locomotion eventually becomes the most conspicuous burden of the patient's life. So long as he is able to get about unaided he may live not only a useful, but comparatively an enjoyable, life; but, when he has to rely upon the arm of an attendant, a pair of crutches, or a wheel chair, fortitude deserts him, and with it hope and usefulness.

Of all the measures that can be utilized to counteract the development

of ataxia, and to overcome it after it has developed, the plan suggested by Mortimer Granville of England in 1881, but formulated and introduced to the profession by Fraenkel of Heiden in 1890, and since then very much elaborated by himself and by Goldscheider, is the most important. The essential feature of the plan is to submit those muscles which manifest the incoördination to a series of graduated and systematic exercises. Each movement thus performed will be accompanied by kinesthetic sensations and memories in the corresponding areas of the brain. Fraenkel has, therefore, referred to the treatment as one of cerebral gymnastics, and in no way to be confounded with gymnastics of force. The underlying principle is that, if the patient is made to overcome the ataxia by the performance of simple movements with purposeful intent and attention, his sensorimotor cortex will become so reëducated that it will direct the movements without attention and conscious volition.

Fraenkel's procedure consists essentially in the exact and methodical execution of purposeful movements which require skill and not force. In the beginning these movements should be very simple, and gradually made more complicated as the patient becomes capable of performing them. They should not be done in a perfunctory way, as are ordinary gymnastics, but with the attention closely concentrated on every movement.

The benefit which follows the use of the exercises is often most encouraging to the patient and gratifying to the physician, especially when used as an adjuvant to the general tonic and supportive treatment already spoken of. Naturally they are of signal service in those cases in which the ataxia and hypotonia are not extreme. Oftentimes, however, patients who are dependent upon crutches may be so benefited by this treatment that they can walk unaided, particularly if the hypotonia is not profound. It must not, however, be forgotten that these exercises have no influence on the disease process, and that they benefit only one of the numerous clinical manifestations, namely, the ataxia.

The cases of tabes most favorable to the employment of Fraenkel's treatment are those in which the ataxia appears very early in the disease; those in which it is of comparatively slow development; those in which the incoördination manifests some tendency toward spontaneous amelioration and those in which the disease process has been arrested. The employment of this method of treatment is contra-indicated in weak, anemic patients and in those who suffer more or less constantly with pains or crises; in cases of acute and subacute tabes, that is, in cases of sudden onset and in which the habitual manifestations of the preataxic period succeed each other rapidly; in patients with tabetic optic atrophy, fragile bones, and those who have had what is generally called spontaneous fracture or rupture of tendons. When any cardiopathy or vascular lesion exists, the method must be tried with great care, if at all. It is not ap-

plicable to very obese or arthritic patients, and, finally, it is absolutely contra-indicated when there are great laxity of the ligaments and severe arthropathy.

The formula for these exercises, which was given by Fraenkel in his communication to the Moscow Congress in 1897, seems rather formidable. The following résumé will aim to give the more important essentials. The illustrations are taken from Goldscheider's brochure on the subject. The physician who undertakes to employ the exercises must needs remember that they demand for their successful utilization a great deal of time and patience, but expenditure of them will be rewarded. Whenever it is possible the exercises should be entrusted to a trained attendant under the observation of the physician. At the Neurological Institute, where we utilize them to great advantage, they are always done in classes and to the accompaniment of music. They should be practiced several times a day for a few minutes at a time, but never to the point of producing considerable fatigue. When they cause great fatigue they should be done principally in the morning or after a long rest.

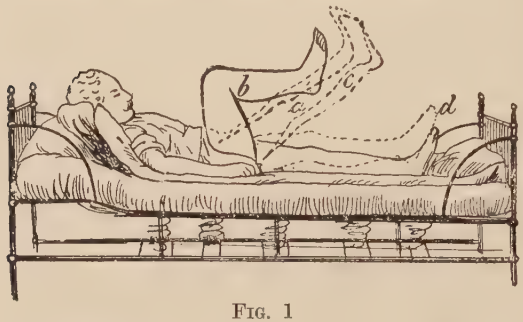

Fig. 1

Ataxia of the lower extremities is commoner and always more severe than of the upper; it is also more difficult to overcome by the Fraenkel movements, because of the associated disorder of equilibrium, which is often so profound. To overcome the ataxia of the legs the patient should begin by making simple, primitive movements that can be executed while lying in bed. For instance, lying on the back with the legs uncovered, he should be required to go through movements of flexion, extension, abduction, and adduction of the different joints of the lower extremities slowly and deliberately and with all the accuracy that can be commanded, first with one leg, then with the other, and finally with both legs simultaneously. Figure 1 illustrates one of the simplest and most important of these movements. It is spoken of as the "fourfold movement exercise." It consists

Fig. 2

in raising the outstretched leg, flexion of the thigh, and then the knee, to make a double right angle, then extending the leg, and finally lowering it. It will be found that these simple exercises are very fatiguing, not so much because of the muscular exertion, but because of the attention that they demand. They should be persisted in, however, until the patient can execute them easily, accurately, and without much effort. Another very important series of exercises is represented by Figure 2. As seen from the illustration, it consists of a short step ladder fixed at the bottom of the bed on which the patient is required to make accurate stepping and climbing movements. Similar movements of precision should then be practiced by the patient while sitting. It is unnecessary to detail the great number of modifications of such movements that can be devised. Care and precision in their execution are most important. These primitive movements are absolutely essential and should not be neglected even by those whose ataxia is not so great as to prevent them from walking.

FIG. 3

The patient should then practice rising deliberately from the sitting position with or without aid, as the condition of his strength and equilibrium demands, and then sitting slowly. As soon as possible he should do this without assistance or support. He should then practice standing upright alone or with support or assistance, with the feet put firmly beneath him, aided at first by the hand or eye, then, as he gradually acquires confidence and skill, without the aid of either and with the feet close together. The physician can be of great service by assuring the patient of his capacity to do this, for much of the disequilibrium is the result of fear and lack of confidence. When he has succeeded in learning to stand alone or with the aid of a stick, he should begin movements of bending forward as far as possible, then slowly raising himself to a vertical position, bending first one knee and then the other, adopting the squatting position and then rising from it, and various others.

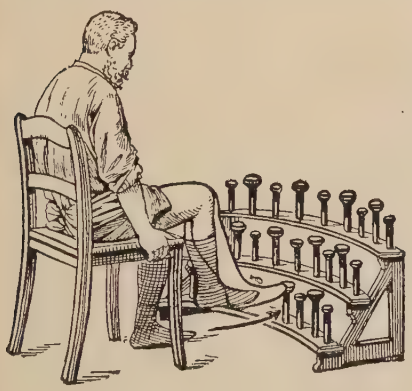
FIG. 4

After this, movements of the lower extremities for the purpose of walking are to be practiced. The patient should stand with the aid of crutches

or a stick and endeavor to put one foot forward slowly, deliberately, and accurately upon a certain marked spot, from 12 to 16 inches in front of him. This should be done five times in succession with all possible precision and accuracy, while the patient or the attendant counts. Then the same procedure is to be repeated with the other foot. After the patient has acquired facility in doing this he should try to walk with the aid of sticks or an attendant, taking each step slowly and with the greatest deliberateness, ten steps forward, then ten steps backward. The patient should also be required to practice walking movements of the feet while sitting. This should be done first with one foot, then with both feet simultaneously, as shown by the accompanying illustration (Fig. 3). Another exercise of considerable service is illustrated by the simple apparatus (Fig. 4). The patient first touches all the round-top shorter uprights and then all the flat-top taller uprights in succession. Of course, when the patient cannot stand or walk even with the aid of a stick or an assistant, it is necessary to provide him with some such apparatus as shown in Figure 5, by which he can support himself while practicing the many different exercises of skill. The exercises that can be devised with such a contrivance are almost innumerable. A few of the important ones are illustrated by Figures 6 and 7.

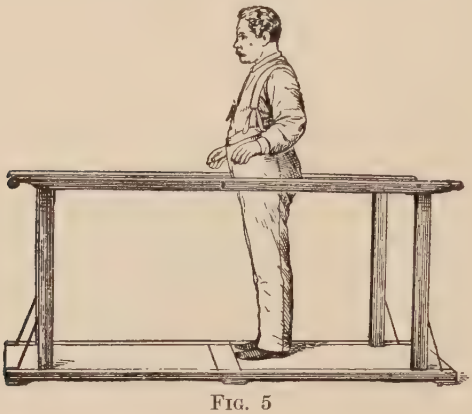

Fig. 5

By assiduous practice of these exercises the patient will soon be able to walk without holding an immovable support. It then remains for him to practice walking in a straight line; to trace figures or lines with the toes and to indulge in other movements of the lower extremities that require accuracy and skill for their execution.

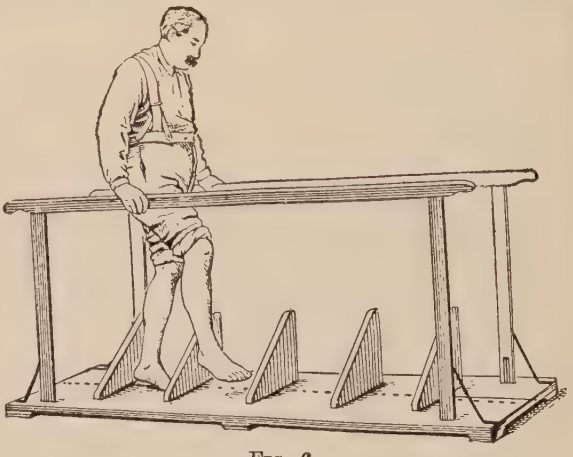

Fig. 6

To overcome the ataxia of the upper extremities one proceeds in a similar fashion. The patient is made to execute simple movements at

first, followed by more complicated ones, with the fingers, hands, and forearms. When the patient can use his muscles without difficulty for these movements, he should be given exercises which require more skill and patience for their performance. Fraenkel has devised for this purpose a number of apparatuses. One of these consists of a piece of wood having the form of a triangular prism 40 cm. long, each side measuring 5 cm. This piece of wood rests on one of its sides. The upper edge is grooved out, one of the others is smoothed off, while the third is sharp. This apparatus is placed before the patient, who holds in one hand a large pencil, and he endeavors to put the point of the pencil in the groove and move it back and forth therein steadily and accurately from the farthest to the nearest end, keeping the fingers and the wrist immovable. At first the patient has considerable difficulty in keeping the point of the pencil in the groove, but after repeated exercises he is able to do so. He should then practice retracing with a pencil simple designs consisting of straight, zigzag, and curved lines. If the tracings of these figures are kept, it enables one to follow the progress that the patient makes toward acquiring coördination. Another apparatus consists of a piece of board in which depressions have been hollowed out at regular intervals, into which the end of the finger can be placed. These holes are numbered. The board is placed before the patient, who holds the right arm raised and the index finger extended. He then puts the end of the finger into the depression rapidly and as accurately as possible when the attendant calls out the number. At first he is made to repeat the same number until he can do it with considerable accuracy. This exercise can be made more complicated by having the patient put marbles in the holes as fast as the number of the holes is called out. This simple device may be replaced by a board filled with holes, in which the patient is required to place a number of pegs, such as a cribbage board.

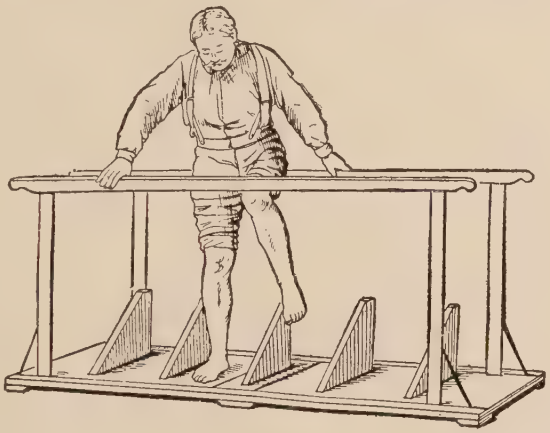

Fig. 7

The great number of variations that can be devised by any one, even the patient himself, will suggest themselves at once to the physician. After the patient has acquired skill in these exercises he can practice with a contrivance consisting of a series of balls of different sizes suspended by threads from a horizontal bar. One of these balls, commenc-

ing with the largest, is made to oscillate, and while it is oscillating the patient is told to seize it and bring it to a state of rest. At first he is left free to choose the moment at which to seize the ball, but later he is required to do so at a moment determined by its oscillatory excursion. This exercise is repeated with all the different balls. The smaller the ball the more difficult the exercise.

O. Foerster has described a definite series of exercises for the upper extremities. They should be done serially, as they are designed to proceed from simple movements and attitudes to the more complex ones. They are as follows:

1. Resting each finger and thumb in the normal attitude of rest.
2. Resting all fingers and thumbs at the same time in the normal attitude of rest.
3. Slow extension and flexion of the fingers at the metacarpophalangeal joints, at first separately, then together.
4. Holding the second and third phalanges in any given position of flexion, at first separately, then together.
5. Synchronous extension and flexion of the second and third phalanges.
6. Extension of the end and middle phalanges while the proximal is flexed.
7. Apposition of the thumb to the fingers.
8. Crooking the thumb and first finger so that the balls touch.
9. Approximation of the extended thumb and first finger so that the balls touch.
10. Holding quiet all the fingers and thumb while the volar sides of the corresponding fingers at the last phalanges are approximated.
11. Separating and bringing together the finger balls of the individual pairs while the hands are held as in No. 10.
12. Grasping a can and piling up several.
13. Grasping the pointers and placing them in the holes of a cribbage board.
14. Placing the fingers in the grooves of a special board and slowly raising and sinking them.
15. Practice in buttoning and unbuttoning.
16. Holding the hand quietly in the normal position.
17. Slow extension and flexion of the fingers.
18. Opening and closing the fist.
19. Grasping larger articles with the hand.
20. Shaking hands.
21. Holding the hand and forearm in a given position, then deliberate pronation and supination.

22. Holding the forearm in a given position of flexion, then deliberate flexion and extension.
23. Holding the uplifted arm in any given position of the shoulder joint, then deliberate raising and lowering.
24. Seizing large objects with the whole hand.
25. Seizing swinging balls of the Fraenkel apparatus.
26. Carrying a spoon to the mouth.
27. Touching the nose with the finger tips.
28. Practice in writing.
29. Copying figures, lines, etc.
30. Keeping the pencil in the groove of Fraenkel's triangular block.

Plan of Treatment.—The importance of a plan of treatment for patients with locomotor ataxia can scarcely be overestimated. The medicinal treatment will not suffice unless supplemented by hygienic, dietetic, physical, and disciplinary measures. The amelioration of the patient's symptoms and the degree to which comfort and longevity can be given him stand in direct relation to the promptitude with which the diagnosis is made and proper treatment instituted. Every patient who consults a physician for an ailment of any kind, aside from the acute infectious diseases, and who gives a history of syphilis, should be carefully put through the tests requisite to reveal the existence of tabes. The necessity of this statement is impressed upon us as our experience with the disease increases. The patients who have been treated for rheumatism, gout, appendicitis and who have been operated for malignant disease, stricture of the urethra or rectum, spinal cord tumor, and other diseases "too numerous to mention" testify to the truth of this. It is scarcely necessary to emphasize how essential it is to carefully scrutinize the patient who comes complaining of pains, vesical shortcomings, altered sexual instincts and capacity, or any of the symptoms of the general neurasthenic condition. At such an early date it may be quite impossible to satisfy one's self of the existence of tabes, but if there is an increase in number of the lymphocytes in the cerebrospinal fluid, it is imperative that the patient be given arsphenamin or mercury *properly and adequately.*

When the existence of the disease is unmistakable, the question must always be decided whether or not to inform the patient. Naturally no general rule can be given, but it is our belief that nothing whatever is to be gained by concealing from the patient the nature of his disease, for fear that such knowledge may have an injuriously depressing effect if he has heard of the disastrous outcome of the disease in others. If the first physician whom the patient consults does not apprise him or one of the family, which is tantamount to telling the patient himself, of the nature of his disease, it is very likely that sooner or later he will consult another physician who sees his way clear to impart such information. The first

physician will then be held to have made a mistake and to have wasted time in treatment which might have been beneficially employed if the exact nature of the disease had been known. It is not wise in the majority of cases to make an unmodified diagnosis of locomotor ataxia in the beginning; nevertheless the patient should be made to understand that his disease is serious, and, in order that it may not disable him, it is necessary to adopt a vigorous plan of treatment for the purpose of stopping the progress of the disease. The important lesson for him to learn is that a long period of usefulness and comparative health waits on methodical and continued treatment. Occasional and desultory visits to a physician which are rewarded by one or two prescriptions are tantamount to no treatment at all.

After getting *en rapport* with the patient and securing at least a degree of his confidence, it is necessary to decide whether or not he shall forego his customary occupation, providing, of course, his position in life allows him to do so. Individual factors in each case must influence this decision. As a rule, unless special indications exist to the contrary, such as a profound neurasthenic state, manifestations of syphilis in the blood-vessels, progressive emaciation, and unless the occupation is one that is conducive to leg weariness and entails great worry and care, it is best to let the patient keep to business. His infirmity prevents him from indulging in many of the pleasures and occupations which help to pass the time. And to take a man accustomed during all the years of his life to engrossing occupation, and throw him at once into enforced idleness, at the same time restricting him from many pleasures which are harmless to the healthy individual, is tantamount to converting him at once into an introspective, depressed, miserable being. On the other hand, if he is allowed to pass a portion of his time in business, while the rest is given over to measures that may be legitimately called treatment, such as walking, golfing, driving, not to speak of the time required for hydriatics, electricity, massage, and rest, he will have little time to think of himself. A rule that admits of few exceptions is that sanatorium treatment is not advisable, at least not until the last stages of the disease.

Tabetics do not tolerate brusque changes of temperature or oscillations of atmospheric pressure. Such changes are apt to be accompanied or followed by attacks of pain, gastric crises, exaggeration of ataxia, and general asthenia. A temperate climate and a moderately dry atmosphere are most favorable for patients with this disease.

In regard to the patient's diet, it may be said that tea, coffee, alcoholic stimulants, and tobacco should be used most temperately. It is poor judgment to insist that a man who has taken these dietetic luxuries in moderation and to his apparent benefit for many years shall give them over entirely, just because certain nerve fibers are beginning to decay. A

mixed diet with a preponderance of vegetables and fats is the nearest approach to the ideal. As in all nervous diseases, functional or organic, the patient should be fed frequently, five times a day at least. The supplementary meals should consist of milk or other food, the taking of which requires no effort on the part of the patient. The tabetic patient who spends twelve out of the twenty-four hours in bed is more just to himself than he who encroaches upon this number. In regard to exercise very little can be said in a formal way. Leg weariness is to be avoided at all hazards. It will be found that the varieties of exercise and sport that are in vogue in any country or section of the country for the average healthy man can be indulged in quite as well by the tabetic patient, providing he is not inclined to be intemperate. It is unnecessary to speak of the importance of avoiding injurious indulgences of all kinds, but patients in the early stages of tabes often seek advice concerning attempts at sexual intercourse, for in many instances sexual potency is not entirely lost until the disease is quite advanced. So far as possible, cohabitation should be avoided, although if there is no pathological excitation no harm can result from occasional indulgence. The general hygiene, including clothing, cleansing baths, regulation of bowels, maintenance of the integrity of digestion, does not require specific mention. As in all other nervous diseases, attention to these details is rewarded by an accession of the patient's nutrition and increase of physical strength.

The use of drugs to maintain nutrition constitutes relatively an unimportant part of the treatment of tabes. Of the general tonics and restoratives iron, arsenic, and quinin are occasionally serviceable, while the simple bitters and dilute hydrochloric acid are to be used for their direct effects on the appetite and digestion. Years ago strychnin was considered essential to the treatment of all diseases of the spinal cord. Its use, however, has gradually been discarded and to-day we hardly ever hear it mentioned even in the attempt to delay a tabetic amaurosis. Long ago we pointed out the danger of increasing the pains, irritation of the urogenital system or of causing psychic disturbances by indiscriminate administration of strychnin.

SPINAL SYPHILIS

Spinal syphilis, lues cerebrospinalis, is for the most part so intimately associated with, or dependent upon, meningeal lesions that most writers at present prefer to treat it under the caption of meningovascular syphilis. We prefer to treat it separately and at this time, because its many manifestations, its protean type, and its pathology entitle it to a place among the systemic affections of the cord. Although the disease is almost invariably dependent upon meningovascular lesions, its clinical forms are

often those of diffuse or simple systemic lesions in which the meningeal symptoms are of little or no significance.

Symptomatology.—The clinical appearances of spinal syphilis, of course, depend upon the character of the pathologic lesions causing them, and, as we have seen how manifold the latter may be, it is not difficult to conceive that the disease may simulate many of the well-known clinical types of neurology. They may be roughly grouped into forms caused by chronic meningitic lesions, where the symptoms will be more or less referable to root disorders. If the process is an active gummatous infiltration, the symptoms will be those of acute myelitis. Slowly infiltrating lesions starting in the leptomeninges cause systemic degenerations. Large gummata of the dura, non-infiltrating in type, cause pressure symptoms; while arterial disease may cause diffuse lesions in white and gray matter or isolated discrete patches, causing a clinical type which closely resembles multiple sclerosis. Then, finally, there is a diffuse infiltration of the leptomeninges which simulates tabes and frequently cannot be distinguished from the latter even with serological examination.

The construction of a simple clinical entity would, in view of the foregoing, be quite a hopeless task; there are, however, a few symptoms that are constantly found in very many cases, and should always excite our suspicion when found. They are: Argyll-Robertson pupil, pain, bladder disturbances, and sexual impotence. They are of little value alone, but, when they appear together with other symptoms, their importance cannot be overlooked. In those forms of spinal syphilis in which the lesion is limited to the meninges and roots, pain is probably the most predominant feature. The pains may be severe, boring, dull, aching; or, if the posterior roots are pinched, the lightning, neuralgic form of pain will be the chief symptom. Girdle pain is not infrequent. The affections of the anterior roots may take the form of simple paralysis accompanied by stiffness, or there may be a complete flaccid paralysis with lost reflexes and reaction of degeneration. A favorite locality for the latter is at the level of the cervical enlargement, causing flaccid palsy and atrophy of one or more muscles of one shoulder girdle, or both. The paralysis may take the Déjerine-Klumpke form for Erb's shoulder-arm paralysis. Pain is always present at some stage of the development, although it is sometimes overlooked.

The symptoms of active gummatous infiltration depend upon the extent and locality of the lesion. Usually the clinical picture is that of incomplete myelitis, in which the Brown-Séquard syndrome and its variations are most prominent. On the other hand, the process may be confined to the posterior quadrants of the cord, and we find ataxic paraplegia with disturbance of all forms of sensibility. The reflexes may be present, abolished, or exaggerated. If the gray matter is invaded atrophy of the corresponding muscles, occasionally with myoclonic or fibrillary twitch-

ing, will be found. The onset is usually rapid, often abrupt, and preceded by pain. The slowly infiltrating forms starting in the leptomeninges are most frequently classified under the title "meningomyelitis," and they, as a rule, constitute the underlying pathological process of syphilitic spastic spinal paralysis. These may appear clinically as Erb's spinal paralysis, or there may be invasion of the other tracts, that is, sensory tracts, and then ataxic and profound sensory disturbances become manifest. Oppenheim pointed out long ago that a modified Brown-Séquard syndrome may frequently be present in these types, and his statement has since been confirmed by many others.

In 1892 Erb separated a group of cases from the mixed forms and called them "syphilitic spinal paralysis." This clinical syndrome is characterized by slowly progressive spastic paresis of the lower limbs, accompanied by pains, irregularly distributed areas of anesthesia or hypesthesia, bladder and rectal disturbances, usually in the form of difficulty in starting the stream, exaggerated knee and ankle jerks, Babinski and Oppenheim phenomena. At that time Erb expressed the belief that, although he could not base his claim upon histopathologic examinations, sooner or later the lesion would be found in the lateral pyramidal tracts and in the posterior columns as well, and that it would consist in simple primary degeneration of these areas. He reiterated this some years later and insisted that his contentions had been borne out by anatomic study. A number of other writers, principally Nonne, Henneberg, Minkowski, and others, have studied the situation with great care, and have come to the conclusion, best summed up by Nonne: there are in reality certain pure cases of primary syphilitic spastic paralysis; the lesion is a primary systemic degeneration of the pyramidal tracts and posterior columns of toxic nature, and not due to focal lesions in the columns.

Extradural gummata cause spinal symptoms by pressure, and they will vary in accordance with the direction and force of the pressure. Not infrequently very confusing clinical pictures are produced by a lateral oblique direction of the pressure.

Syphilis of the spinal vessels is capable of producing many varieties of symptoms. There may be sudden apoplectiform paralysis of the type caused by hematomyelia; there may be the typical symptom-complex of syringomyelia; there may be anterior horn lesions producing chronic progressive muscular atrophy, or a combination of the latter with system disease of the posterior columns or lateral tracts, thus combining the atrophies with spastic or ataxic phenomena, with bladder disturbances and hypesthesias or paresthesias.

Syphilitic disease of the blood-vessels often causes small punctate foci of hemorrhage and degeneration in the tracts, and the picture of combined sclerosis results. Several cases of disseminated patches, luetic

in nature, have been reported which clinically bore the marks of multiple sclerosis.

The tabetic form or "pseudotabes," as it is called by some, so closely simulates tabes that it is often impossible to distinguish it from the latter. It begins shortly after the primary syphilitic infection and it develops rapidly; the symptoms of pain, girdle sensation, ataxia, Romberg, are very intense, and the progress is often startlingly hurried.

Pathology.—The anatomic changes found in cerebrospinal lues are many and of widely different forms. The most frequent changes are found in the leptomeninges—diffuse infiltrating collections of small round cells which penetrate the cord *en masse* or as slender prolongations. In severe forms the pia-arachnoid is swollen, infiltrated with round cells, forming a ring about the cord, compressing it and interfering with the circulation. The arachnoid alone may be invaded in the same way, the pia and dura remaining untouched. The inner surface of the dura may be the seat of these low-grade inflammatory changes, and they choose the exits of the spinal roots as point of predilection. Rarely are the entire cord and its coverings affected in this manner. It usually occurs at different levels and with varying degrees of intensity in the same individual. The vessels of the cord and membranes are for the most part the seat of active inflammatory changes, which consist in obliterating endarteritis, thickening of the media, hyalining degenerations, and perivascular lymphocytic infiltrations. The lesions within the substance of the cord are vascular in origin in the greater number of cases. They are not confined to any particular area, but may affect gray and white matter equally. Sometimes small punctate hemorrhages or extravasations may be the starting points of system degeneration, or intense glia reactions about the vessels and subsequent formation of small foci of softening with lymphocyte infiltration and granular cells. In the early stages the axis cylinders may show a true myelitic reaction, that is, swelling of the medullary sheath, bursting of same into balls and buds of degenerated myelin, and loss of the axis cylinder proper. The gray matter may degenerate into small foci, which later become confluent and present the picture of syringomyelia. Occasionally true gummata of the dura are seen.

If the process is chronic, it may be confined to the dura and limit itself to slow progressive connective tissue proliferation, which later extends to the pia-arachnoid, becomes hard, firm, and contracts. Histologically we find the dura metamorphosed in thick, fibrous connective tissue which is invading the pia-arachnoid, poor in vessels, and shows a tendency to twist and form concentric knobs or warty growths. This is known as pachymeningitis hypertrophica.

Erb's type shows no true syphilitic changes. It is rather postsyphilitic in character, and consists in primary degenerations in the lateral pyramids, posterior columns, with slight degeneration in the periphery.

Diagnosis.—The diagnosis of spinal syphilis has been made much easier for us since the introduction of careful serological examinations. Spinal lues differs from non-syphilitic diseases by the presence of lymphocytosis of the cerebrospinal fluid, marked excess of globulin, and positive Wassermann reaction in blood and fluid. The differentiation from tabes and taboparesis rests on the enormous number of lymphocytes—90 to 1,400 per c. mm.—and the tremendous increase in globulin in the former, whereas the percentage of positive Wassermann reactions is slightly higher. Whenever it is impossible to make these examinations, we are forced to rely on the rapid development, Argyll-Robertson pupils, bladder disturbances, and irregular distribution of the changes in sensation. The presence of cerebral symptoms is also of great help; the isolated root symptoms and irregular course enable us to distinguish the condition from chronic myelitis of other causation. It is to be distinguished from the non-syphilitic forms of combined sclerosis by the history of infection, presence of Argyll-Robertson pupils, optic neuritis, and other cerebral signs. The differentiation from multiple sclerosis is often impossible clinically, and can be made only by therapy.

Prognosis.—The prognosis depends upon several factors: (1) the activity of the process; (2) the location of the lesion and its character; (3) its amenability to treatment.

(1) In rapidly infiltrating processes, where it has gone unrecognized for a long time, the prognosis as to both recovery and life is uncertain. We may by active antisyphilitic measures be able to check the specific disease, but unable to influence the progress of secondary degenerations. On the other hand, if recognized early enough, this process should yield promptly, and we should expect marked improvement and even recovery. (2) The location has great influence on the prognosis, for, if the lesion is within the gray matter or even in the meninges, repair of the damaged tissues is very slight, and we can only hope to arrest the progress.

Treatment.—If the diagnosis of spinal lues is once established a vigorous antiluetic treatment should be instituted immediately. Even in cases in which the diagnosis is doubtful the same plan should be followed. The purpose of this is twofold: in the first place, we destroy or attempt to destroy the pathogenic organism and thus arrest the progress of the disease; and, in the second, we allow the system an opportunity to absorb toxic products, carry off deleterious matter, and repair the tissues that have been disturbed but not destroyed. There are three agents most useful for this purpose—arsphenamin, mercury and its salts, and iodid of potassium. The specific action of the last named has often been questioned, and to it has been ascribed rather a rôle of alterative, assisting in repair and prevention of connective tissue formation. If given in large quantities Neisser believed it had a true specific action, but this we doubt and deny, at least as far as our experience goes. The selection of

arsphenamin or mercury as the antisyphilitic agency to be used rests with the individual preference of the physician. If arsphenamin is selected, the first dose should be a moderate dose given intravenously, and should be repeated at intervals of one week to one month for four to six doses. If, because of optic neuritis, gastro-intestinal disturbances, or marked debility, we prefer to give mercury, it should be given preferably as inunctions, gr. xx—3ii—rubbed in thoroughly in the orthodox manner. Daily injections of 1/3, 1/4, or 1/6 gr. of bichlorid or enesol, highly recommended by the French, may be injected daily, or salicylate of mercury suspended in liquid albolene, 1 to 2 gr. once a week. Iodid of potassium, starting with 10 gm. t. i. d., may be given in increasing doses up to the limit of tolerance of the individual. Minute, careful attention to the general hygiene and daily routine of these patients is very essential. Hot baths, while taking mercury, are very beneficial. They should be taken every week, as often as two or three times, and hot enough to induce perspiration. Whenever possible, these patients should be sent to one of the numerous baths—Arkansas, Virginia Hot Springs, or Richfield Springs in this country, Aix-la-Chapelle, Neuenahr, or Baden-Baden, in Europe—at the completion of a course of treatment. Often a mild course of tonic baths at home is beneficial.

For the relief of pains the same methods should be employed as in tabes dorsalis: spinal irritation with cautery-blisters, faradic brush, or galvanism, massage, passive joint exercise, and prolonged hot baths for the spasticity.

If medical treatment fails to relieve pain, surgery must be employed. Nerve stretching, excision or evulsion of painful nerves, or section of the posterior roots must be tried.

FRIEDREICH'S ATAXIA AND HEREDITARY CEREBELLAR ATAXIA

Hereditary spinal ataxia is a degeneration or lack of development of the peripheral sensory neuron and the central motor neuron in their spinal course, constituting posterior and lateral sclerosis of the cord. It is a rare disease of childhood, very chronic in its course, and unamenable to every form of therapy. The three important etiological factors of the disease are: the family history, the age when the symptoms first occur, and the relationship of acute disease. The name hereditary spinal ataxia is misleading, because in at least one-third of the cases there is no evidence whatever of immediate or remote heritage of the disease, and in upward of 10 per cent of the cases there is no history of pathological heritage of any kind.

The most striking fact in the etiology is the occurrence of the disease in more than one member of the family, though even this is not discernible in all cases. It is more apt to occur in large than in small families, and at times it seems to affect the male members while the females escape, and vice versa. Although all the members of a family are not affected, unless in exceptional instances in which the number is very small, the remaining members may show some other form of degenerative nervous disease, and possibly nervous disease of a teratological nature. The immediate and remote family history may show the existence of some degenerative neurosis or psychosis, such as epilepsy, hysteria, inebriety, and migraine. The disease develops, as a rule, between the ages of five and fifteen; it sometimes occurs in a recognizable form before that period, and has been recognized as early as three years; the number of cases occurring after the fifteenth year is not very great, and they probably belong to the cerebellar type.

It has often been noted that, when the disease occurs in several members of the same family, it appears in the first patient within late childhood or early maturity, while in each succeeding patient it appears at a less advanced age. The factors that apparently have something to do with exciting the disease, at least to such activity that it becomes recognizable, are the infectious diseases—naturally those common to childhood —and injuries. The influence which these factors have may be interpreted in two ways: The acute infectious diseases may have nothing whatever to do with causing the disease except in so far as they weaken the neuromuscular system and keep the patient in bed, during which time complete coördinated movements, such as walking, running, and climbing, which the person may have but recently mastered, are partially forgotten. Either of these factors, or both combined, may be sufficient to make noticeable the most striking feature of the disease, namely, incoördination, which had existed before the infection. On the other hand, infectious processes and their products may act injuriously upon neurons robbed by heritage of their complementary development and cause them to degenerate. This latter belief I hold to be extremely improbable. A number of cases have been reported in which the disease was ushered in by a febrile state. What the genesis of this fever is has not been suggested, but it seems that the explanation of its injuriousness is the same as that offered for the infectious diseases. A number of other etiological factors of comparatively insignificant importance are the occurrence of the disease more frequently in males than in females, oftener among the poor than among the rich, and the recording of no case in other races than the white. These facts, with the exception of the last named, are in entire accord with the teachings of other familial and hereditary diseases, all of which show themselves more frequently in males and in people of the lower walks of life. The disease is met with in the poor and unenlight-

ened, because parental consanguinity, excessive fetation, and malnutrition are commoner.

Symptomatology.—The most striking feature of Friedreich's disease is the disturbance of gait. It consists of a profound disturbance of equilibrium; ataxia in all purposeful movements of gait and static incoördination, and in well-developed cases there is a play of jerky, inconstant muscular movements for the purpose of maintaining equilibrium. The ataxia during the earlier appearances of the disease may be limited to a slight unsteadiness of gait, or awkwardness of the hands and arms on attempting finely coördinated movements. When the incoördination is very pronounced, all sorts of equivalent postures are adopted to maintain equilibrium, that is, tilting of the pelvis, forward stretching of neck and head, and lateral balancing movements of the trunk. The purposeful muscular movements are executed with more irregularly exaggerated excursions even than in tabes, and, as Déjerine points out, betray a dysmetria which may be elicited by the ordinary tests. Athetoid and choreic movements have also been described. As the disease progresses true asynergia may develop with dissociation of the various synergic components of the shoulder, girdle, trunk and pelvic girdle. Muscular weakness is a very prominent feature in the later stages, and is accompanied by more or less symmetrical wasting. Actual paralysis is rare, except when the joint movements are limited by the deformities. Muscle tonus is not always lowered, as in tabes, and is sometimes increased. Romberg's sign is not always present, and in Friedreich's original article it is mentioned as absent. It has since then been observed many times, and its presence or absence has no particular diagnostic significance. The reflexes are either diminished or absent. Sometimes an apparently absent knee or ankle jerk may be elicited on reinforcement. Diminished myotatic irritability usually accompanies the muscular wasting. Babinski's sign is nearly always present, whereas the cutaneous reflexes conform to no general rule. Deformities occur in very many cases. They appear in the spine, usually as scoliosis, but often marked lordosis is seen. Perhaps the most constant deformity is that found in the feet. It consists in a well-marked pes cavus, Friedreich's foot or pied bot. We consider it to be a sign of great diagnostic importance. In addition to the shortened high arch, there is a peculiar extension of the proximal joint of the great toe with flexion of the distal joint. Claw hand has also been described (Menant). Nystagmus very frequently occurs in these cases, sometimes static, sometimes dynamic. It is not always constant, however, and when it occurs we should always suspect the cerebellar type of the disease. The usual behavior of the pupils is normal, although Argyll-Robertson pupils have been noted. Optic nerves are also normal, but we have seen 1 case, that of a young girl of twelve, with typical Friedreich's ataxia, in which there were double optic atrophy and sluggish pupils. Another cerebal feature of the disease is the pecu-

liar slow, jerky, at times explosive, nasal speech disturbance. The voice is monotone, and there is often a definite catch of breathing between words or even syllables. It is perhaps the most striking instance of ataxic speech that we encounter.

Sensory disturbances do not occur, as a rule; but paresthesias, hypoesthesia of the extremities, diminished position sense, and lancinating pains have been described. The ordinary trophic disturbances of tabes are practically never found. Bladder and rectal functions are rarely disturbed, although the sedentary life these patients lead usually induces constipation.

Hereditary cerebellar ataxia (*hérédo-ataxie-cérébelleuse*) as described by Pierre Marie in 1893, was based on a group of cases published without autopsy by different authors, which showed the affection in several members of the family or similar hereditary phenomena and began between the ages of thirty and forty-five. Subsequent autopsies of these cases have shown a disappointing lack of uniform pathologic lesions and many of the cases also presented symptoms referable to other parts of the brain. As Gordon Holmes says, we must regard it, not as a pathologic entity but rather as a term of convenience to designate certain cases having certain common clinical manifestations although caused by different pathologic lesions. The general belief at present is that Friedreich's ataxia and hereditary cerebellar ataxia are different clinical pictures of the same fundamental process of extensive degenerative congenital lesions of the nervous system, and that they differ rather in the distribution of the lesions than as clinical entities. Hereditary cerebellar ataxia appears usually at a later age than Friedreich's, that is, thirty years, and is more rapidly progressive. In a few instances it has been known to appear as late as forty-five years. The etiology is as obscure as Friedreich's but its family and hereditary features are more constant. One can nearly always distinguish the familial manifestations, but it is not always so easy to establish the hereditary traits. Males are more often affected than females. The same etiologic features prevail as in Friedreich's disease, and, just as the latter depends upon developmental anomalies in the cord, so it depends on faulty structural development of the cerebellum. Therefore, it is our belief that injuries, infections, emotional disturbances can have significance as contributory factors only.

Symptoms.—The symptoms of hereditary ataxia are those of profound cerebellar asynergia: Uncertain, staggering, titubating gait which frequently contains certain elements of spasticity. The patient walks with his feet wide apart, the pelvis forward, the trunk backward, the head backward and swaying. Analysis by slow motion pictures demonstrates the fact, that, as Weisenburg says, it is really a trunkal gait. The trunk moves forward, backward or to either side and the legs complete the effort of the individual to regain equilibrium. Posture is readily maintained when the

patient sits or lies down, but the asynergia of arms or legs may readily be demonstrated on voluntary movement during either of these postures. There is marked exaggeration of mimic during speech or emotional states, which is not at all unlike the emotional play in multiple sclerosis or lesions of the basal ganglia or tegmentum. The speech resembles that of Friedreich's ataxia, but is more explosive and jerky. The tendon jerks are always exaggerated, ankle clonus is sometimes present, and the Babinski phenomenon is always to be found. Coarse, irregular nystagmus is frequently, although not invariably, present, and sometimes paresis of the external recti. A very constant feature is the mental impairment which sooner or later appears during the course of the disease. It varies from slight stupidity to dementia; idiocy, epilepsy, and Ménière's syndrome have been described as possible complications.

Pathologic Anatomy.—The spinal cord is remarkably thinned in these cases of Friedreich's disease, and the cerebellum often is also remarkably small. This is regarded by most writers as a definite anomaly of development. In Friedreich's disease the degeneration involves principally the posterior columns and direct cerebellar tracts. The lateral pyramidal tracts are, as a rule, moderately affected; the direct pyramidal tracts are untouched. Clark's columns are severely affected, but the anterior horns and the spinal roots, both anterior and posterior, are usually unaffected. The cerebellum is atrophied to a remarkable degree in the cerebellar type. It is a general atrophy of all the elements. The arborizations are small, the central white masses are thin, and appear like lamellæ. The cellular elements are always affected. Diminution in size and number of the purkinje cells has been noted. In both types there is astonishingly little secondary reaction in the glia, small round cells, or in the vessels. The cerebellar connections with the oblongata, that is, the restiform body and pons, are usually smaller, and the tracts degenerated.

Diagnosis.—The differentiation of these two forms is often difficult, and sometimes impossible. Exaggerated reflexes suggest the cerebellar type, pes cavus suggests Friedreich's type. Exaggerated emotional facial play suggests the cerebellar type, as do mental disturbances. On the other hand, deformities suggest Friedreich's type or mixed forms. It is sometimes hard to distinguish these types from multiple sclerosis. Often it is impossible to do so, but the absence of abdominal reflexes, the irregular course of the disease, attended by progression and retrogression and accompanied by emotional disturbances, are in favor of the latter. A steady, slow progression with the characteristic deformities is in favor of Friedreich's disease.

Treatment.—The treatment of these two forms of ataxia is identical and consists in providing the patient with an intelligent attendant or nurse who will practice and instruct him in the system of purposeful gymnastics, known as Frenkel's movements. This system of systematic

exercises for training the ataxic limbs is described in the chapter on the treatment of tabes. These, with measures taken to maintain the strength and nutrition of the patient, are all that can be offered in the shape of therapy. It is not probable, even though we treat the patient from the very beginning of the disease, that medicines, such as silver, aluminium, and iodid of potassium, which sometimes have a beneficial effect in preventing the rapidity of development of certain spinal cord degenerations, would be of any service in this disease. The spinal curvature rarely calls for direct treatment, but many patients are more comfortable when they wear a light wooden or plaster jacket. Parents to whom are born one or more children who afterward manifest a disease of this kind should be advised to surcease procreation. If they do not, the endeavor should be made to avoid the factors that seem at times to act as exciting causes—the infectious diseases and injuries.

Spastic hereditary ataxia, spastic heredodegeneration, or hereditary ataxic paraplegia has been described. These cases really belong to the mixed forms of the group just described, and are characterized by the prominence of the spasticity, exaggerated tendon jerks and the more or less rapid course of the disease.

ACUTE MYELITIS

The term "myelitis" has been and is applied both clinically and pathologically with much latitude. It is used to indicate the changes in the cord, the résult of acute inflammation, disease of the walls, and partial or complete obliteration of the lumen of the vessels (myelomalacia), pressure upon the substance of the cord the result of accident, disease or new growth of the surrounding tissue, and the vascular and parenchymatous changes developing from lessened atmospheric pressure (caisson-disease).

The designation acute myelitis should be restricted to indicate an acute exudative and destructive inflammation of the spinal cord involving the white and gray matter, of variable extent, in vertical or tranverse direction, and occurring at any level. As a rule, the inflammation is of the dorsal or upper lumbar segment, and the focus of the morbid process is more extensive in a transverse direction. Thus the disease is often spoken of as acute transverse myelitis. The pathological products vary with the inflammatory excitant and with the intensity of the infection. The trend of modern scientific thought is to associate the occurrence of inflammation with some bacterial cause, but there is nothing approaching unanimity as to what constitutes the essentials of inflammation or inflammatory reaction. It is quite impossible to distinguish clinically the myelitis which is the result of a pathogenic organism, such as that of in-

fluenza or typhoid fever, from the myelitis or myelomalacia that accompanies syphilitic degeneration and thrombus of some of the spinal blood-vessels. Neither is it always possible to distinguish them anatomically, after the cases come to autopsy, for the exudative and destructive changes that go on around such a focus or a number of foci are practically identical with those of primary inflammation. Indeed, the reactionary changes around such foci may be so great that they more or less obscure them and prevent their ocular demonstration. The pathological product of acute myelitis is never pus, except in those rare instances in which the myelitis is due to pyogenic organisms, in which case it may be circumscribed to constitute a more or less diffuse abscess of the spinal cord. Purulent myelitis is almost invariably associated with and secondary to purulent leptomeningitis.

Acute myelitis may be classified *regionally* with respect to its location in the cervical, dorsal, or lumbar regions; *topographically* according to major extension as transverse and longitudinal; *etiologically* as traumatic, infectious, toxic, and refrigerant; and *clinically* as acute and chronic. When the inflammation of the cord is accompanied by or is secondary to inflammation of the meninges it is known as meningomyelitis.

Etiology of Acute Myelitis.—The causes of acute myelitis are the same as those of other acute parenchymatous inflammations. Naturally, certain influences are more harmful to the spinal cord than they are to other tissues. Any depreciation of the circulation and nutrition of the cord, or, in other words, any diminution of its resistivity, may act as a powerful predisposing cause to microbic invasion. In this way is to be explained the action of cold, fatigue, especially of the legs, such as is induced by prolonged or violent muscular effort, sexual excess, and trauma insufficient to cause solution of continuity. These factors are usually considered exciting causes of acute myelitis, and very frequently some one of them is the sole detectable cause. Of these attributed causes exposure to cold is by far the commonest and most pernicious. It is possible that of itself it is sufficient to excite inflammation in the cord, as this has been done artificially in the lower animals by means of an ether spray. Infection is more liable to occur in middle adult life than at any other age. Despite the fact that acute myelitis often develops in the wake of infectious diseases, children are rarely affected. There is no preferential liability with respect to sex other than that engendered by the occupation of males, predisposing by exposure, fatigue, the action of poisons, and the liability to injury, and by pregnancy and the puerperal period in the female. The insignificant seasonal relationship of the disease, namely, its more common occurrence in winter and spring, is clearly related to exposure and cold.

The infections that are most frequently followed by acute myelitis are: pneumonia, typhoid fever, erysipelas, diphtheria, influenza, puer-

peral fever, malaria, gonorrhea, infectious endocarditis, scarlatina, and variola. Of these the infections of pneumonia and influenza are by far the most pernicious. How these infectious agencies act to produce myelitis is not clearly understood. Naturally, their direct presence in the spinal cord would be certain to set up inflammation. But it is much more probable that they produce poisons of the nature of toxins which single out the spinal cord for their activity. In this way is explained the occurrence of myelitis some time after the infectious disease with which it stands in causal relationship has ceased to exist. Whether or not the immediate pathological precedent of such infectious myelitis is a minute embolus or thrombus has not been definitely decided, but it would seem that, in some cases, at least, this constitutes the first pathogenic step. Acute myelitis has been produced experimentally in animals by the injection of cultures of erysipelas bacilli, colon bacilli, staphylococci, pneumococci, tetanus bacilli, Loeffler's bacilli, Eberth's bacilli, etc. Of the infections, tuberculosis is probably the most common. It is usually but not invariably associated with involvement of the meninges. In a case studied recently we were able to demonstrate the tubercle bacillus in the myelitic area.

The poisons that stand in causal relationship to the occurrence of acute myelitis are of endogenous and exogenous origin. The latter are least important, although lead, arsenic, mercury, phosphorus, and carbon monoxid are occasional attributable causes. The rôle played by alcohol in the causation of acute myelitis is not a very prominent one. It acts indirectly by leading to exposure and injury, rather than by its inherently pernicious effect on the cord. Toxic agencies arising within the body have a more malign influence. The most important of these are due to diabetes, uremia, and gout. Acute myelitis sometimes occurs with disease of the urinary organs, such as cystitis and pyelitis. An attempt has been made to explain such occurrences by saying that it was an extension of inflammation or of the inflammatory excitants directly from the tissues primarily diseased to the cord, but this is wholly unlikely, and the pathways of approach are probably the endolymph channels of the efferent veins of the spinal canal. Just as in brain abscess following mastoid disease, the infectious material travels across small, bridgelike, newly formed adhesions and thus reaches the cord. The occurrence of myelitis with exfoliative dermatitis and after burns that have denuded a considerable surface of the body is explained in two ways: (1) that these lesions cause the development of toxic protein split-products which are absorbed into the system; and (2) that they act upon the sympathetic system to produce vasomotor derangements in the cord which go on to inflammation.

Trauma is a relatively uncommon cause of myelitis, except in those instances in which the trauma is sufficient to produce physical disin-

tegration of the substance of the cord, as from fracture and dislocation of a vertebra. Slighter trauma may open the surface to the invasion of bacteria, or it may cause marked depreciation of the circulation and nutrition of the cord.

Myelitis is met with in a number of blood diseases, such as profound anemia and leukemia, occurring primarily or secondarily to malignant disease, such as carcinoma, and to some chronic disease, such as nephritis. Here, again, it must be said that the lesions forming the anatomical basis of such forms of myelitis are not true inflammatory ones. Their pathogenesis consists in the occurrence of minute thrombi or emboli, with resulting myelomalacia, which cannot be distinguished from acute myelitis. The acute myelitis that occurs in animals when the blood supply is shut off by pressure upon or ligation of the aorta, and in man with aneurysm and partial occlusion of the abdominal aorta, is pathologically a true anemic necrosis, with subsequent surrounding reactionary myelitis.

Myelitis may be secondary to an inflammation of the surrounding structures—the meninges and the vertebræ—although this is not an important causation. There is some evidence tending to show that it may be secondary to an ascending peripheral neuritis, particularly from the nerves of the trunk. Such a case has never come under our own observation.

Pathology.—On removing the cord the meninges are usually injected, cerebrospinal fluid is increased, and the cord is softer than normal. On account of its consistency, artefacts are very easily produced in the removal, and they are often difficult to distinguish from the true lesions. If the lesion is an acute transverse one with intense inflammation, the consistence will be pulpy. In the acute stages the cut surface shows small reddish punctate areas, digitations pushing in towards the center, obliteration of the markings, small area of necrosis, and occasionally cavities; the vessels are swollen, tortuous, and stand out prominently. In later stages the reddish areas are transformed into grayish whitish patches, the necrosed areas are more easily distinguishable. The meninges are thickened, especially the pia-arachnoid, or may not appear changed in any way. Where the process has proceeded from the meninges they are thickened, glued together, and sometimes the subdural space is filled with a glairy, gelatinous mass. Histologically, we find lesions of the most varied degree. In severe transverse cases the markings of the cord disappear, the white and gray matter are indistinguishable, the nervous elements are no longer recognizable, except here and there a pale, poorly stained ganglion cell or a few swollen axones. The glia persists as a few indeterminate fibers. The area is composed of granular cells in various stages of necrosis, and a poorly staining amorphous mass of necrosed tissue. In the less severe types there are small foci of variable sizes, scattered irregularly throughout the diseased area. They are sometimes

found, appearing in white or gray matter as digitations pushing in from the periphery of the cord. The foci are composed of granular cells of vascular, glial, or connective tissue origin; spider cells usually around the periphery of the focus, swollen axones, fragments of myelin, and occasionally endothelial cells. The reaction in the fibers is more or less intense. The axones are swollen and tortuous, the myelin fragmented, and the sheath swollen to two or three times its natural size. The swollen sheaths frequently become confluent with the edge of the focus, and form large spaces, which are called Lückenfelder by the Germans. Marchi stain shows intense degeneration, fatty infiltration of the granular cells, the vessels, and the glia. The vessels within the foci exhibit all forms of degeneration, that is, hyalin, thickening of all three coats, emboli, thrombi, or endarteritis obliterans. The softening process may spread by confluence of several foci, or the latter may remain isolated. If the process is severe enough, the softened necrosed material becomes absorbed, and small cavities appear and enlarge. When the foci appear in the gray matter the ganglion cells within are destroyed or distorted, the nucleus often being the only element that preserves its tinctorial reaction to any degree. Those on the edge of the focus are in various stages of chromatolysis, from the coarse granular to the dusty appearances of the Nissl bodies, and there are usually increase of pigment and formation of fat droplets.

As the acute process subsides the necrotic elements are absorbed and the process of repair begins. This is accomplished by the glia, which begins to proliferate and form new fibers that hypertrophy and form the so-called scar formation. Those of the true nerve fibers that have not been completely destroyed become clothed with the myelin sheath again. The optic nerves when affected are sometimes simply swollen and edematous, but usually show small foci similar to those in the cord. The foci usually contain small hemorrhages or transudations.

The purulent forms are rare, and usually occur with meningomyelitic lesions. The pus infiltrates the arachnoidal meshes, everywhere there is leukocytic infiltration, and the direct extension from the vertebral column can usually be demonstrated.

Symptoms.—The symptoms of acute myelitis vary with the location and extent of the lesion. The introductory symptoms, which are independent of the location of the inflammatory foci, come on with great abruptness, constituting the apoplectic variety, or, in a few days, constituting the acute variety, or, in a few weeks and often somewhat intermittently, constituting the subacute variety. Usually the first sensory and motor irritative symptoms are followed by more or less complete paraplegia. When the lesion is of the dorsal cord, its commonest location, the symptoms consist of paraplegia, pain in the back radiating into the trunk and legs, and more or less anesthesia, paralysis of the bladder

and eventually of the rectum; exaggeration of the knee jerks and later spasmodic twitchings and contractions of the leg; vasomotor and trophic disturbances, consisting of bed-sores, slight edema of the legs, coldness of the extremities, and occasionally the formation of bullæ. The muscles waste, but do not atrophy, and there is no reaction of degeneration. When the inflammatory foci are in the lumbar region, the paraplegia that occurs is of the flaccid variety, and there is atrophy of the muscles with reaction of degeneration. The superficial reflexes are weak, and the tendon reflexes are usually lost. There is a variable amount of anesthesia in the paralyzed parts, and the rectal and vesical insufficiency is profound. When the myelitis is of the cervical cord, the general symptoms are more severe and there is, in addition to the symptoms indicative of dorsal myelitis, motor paralysis of the arms or of individual muscle groups, usually of an atrophied character. There may likewise be oculopupillary symptoms, disturbance of respiration, and bradycardia. If the lesion is adjacent to the oblongata, the bulbar symptoms will be more pronounced.

Oppenheim described a conus type, in which the symptoms were paresis of the bladder and rectum, sexual impotence, anesthesia of perineum, anus, penis, scrotum, and the upper portions of the inner surfaces of the thighs.

The incomplete forms of myelitis exhibit, as one might imagine, a most variable group of symptoms. As the process is not necessarily limited to one segment, it may be distributed widely throughout the cord. In not a few cases the spinal symptoms are preceded by retrobulbar neuritis and by optic neuritis, whose origin is very puzzling. The optic affection may be limited to one or include both eyes. We have recorded two such examples. After such symptoms have existed for a short time, the real spinal affection appears, simulating tabes dorsalis, multiple sclerosis, or ataxic paraplegia. It is very complex in its clinial appearance, and often is only to be distinguished from the latter by its rapid course. In these forms we frequently see the Brown-Séquard type of dissociated sensory disturbances. If the infection is a severe one, it is accompanied by fever, chills, and sometimes delirium, stupor, and speech disturbances from the beginning. The onset may occasionally simulate acute poliomyelitis. In the subacute and chronic forms there may be an interval of months before the disease has reached its height. As yet there is little to be learned from a study of the cerebrospinal fluid in these cases.

The course of the disease varies with the causation and with the intensity of the infection. It is always progressive, but after a variable time, unless death occurs, it becomes more or less stationary, with resulting secondary degeneration, ascending in the sensory tracts and descending in the motor tracts, the latter predominating. The disease eventually causes death by exhaustion and by infection from the urinary organs and bed-sores.

The diagnosis is made by the abrupt or rapid onset and establishment of the disease in a few hours, days, or weeks. It is to be differentiated principally from multiple sclerosis by its course, fever, and absence of emotional phenomena. The diagnosis of tumor compression from disease of the vertebra will be discussed later in its proper place. It is to be differentiated from embolus of the aorta by absence of pulsation in the iliac arteries.

The prognosis varies with the intensity of the infection. In severe transverse lesions it is unfavorable. In the disseminated types the chances of life are better, but complete recovery has been recorded only a few times.

The gonorrheal form is the most favorable, most of the cases recovering completely in a short while—from six to twelve weeks (Oppenheim). The cases occurring in puerperal fever frequently recover. Those during the menopause are rather unfavorable. It has been said that those cases with acute onset and multiple distribution of symptoms usually have a favorable prognosis, though this has not been our experience.

Treatment.—Considering the almost invariable outcome of acute myelitis, the treatment of the disease is thankless and dispiriting. Nevertheless, much can be accomplished by appropriate treatment to limit its extent, to alleviate suffering and misery, and to avoid in a measure some of the distressing secondary occurrences. The possibility of an abortive treatment of acute inflammation of any organ is problematical, but it is certain that there is none for an acute inflammation of the spinal cord. Yet something can be accomplished in the direction of lessening the intensity of the inflammation and shaping its course toward partial restitution. The appropriate treatment naturally varies with the cause of the disease, although all varieties of acute myelitis call therapeutically for two things: first, *absolute rest;* and, second, *absolute cleanliness.* It may legitimately be said that, just in proportion as these two requirements are fulfilled, so will the chances of partial recovery of the patient and the duration of life be increased. The patients should be put to bed and kept there, and they should not be allowed to move under any circumstances. The changes of position which are advisable, either to keep the parts on which pressure is most severe from becoming the seat of bed-sores, or for the purpose of influencing the circulation in the cord, should be done by an attendant. It is advisable, if the condition of the patient allows it, to have him lie on the belly or side for a part of the time. The greatest care should be exercised in the selection of a mattress and in the arrangement of the coverings and clothing of the patient, so that irregular pressure on the surface of the body is avoided. Whenever it is at all possible, the patient should at once be put upon an air mattress. Unfortunately, the physician sometimes waits for the occurrence of trophic symptoms before insisting upon this. Much trouble and suffering can be avoided by order-

ing it at the beginning. The most scrupulous cleanliness must be insisted upon. Warm water and soap should be used at least twice daily, followed by rubbing the skin with alcohol and by dusting with the blandest antiseptic powder. The condition of the bladder and bowels should be made an object of special attention from the start. If this is neglected, symptoms are sure to develop which point to infection, intoxication, and depreciation of vitality, and which will seriously jeopardize the patient's life. When it is impossible to catheterize the patient regularly, males should be provided with a urinal so adapted that every drop of urine passes into it, while females should have absorbent cotton surrounded by gauze or oakum so arranged that it catches every drop, and this should be renewed every two hours at least for the first few days, and after each renewal the parts thoroughly cleaned. Urotropin and other substances that have antifermentative properties should be administered freely. The bowels should be moved regularly by the use of simple enemata. If there is incontinence of feces, efforts to secure and maintain cleanliness must be redoubled.

If the myelitis is postinfectious, the treatment required, in addition to that mentioned above, consists in the administration of medicines that prompt the emunctories to activity, so that the elimination of the poison from the system may be facilitated. It is advisable to give an intestinal laxative and antiseptic, such as a dose of calomel followed by a saline, and a few brisk doses of some bland diuretic and diaphoretic, particularly if the patient is a robust, full-blooded individual, and to follow this by the administration of small doses of salicylates and quinin, both of which, fortunately, tend to alleviate the pain. If the case is seen in the beginning, it is very advisable to put an ice-bag over that portion of the spine where the lesion is situated, whenever an opportunity is offered by a favorable position of the patient. All forms of stimulant and irritant applications to the spine should be rigorously avoided during the acute stage of the disease. The skin is the seat of profound depreciation of nutrition, and it does not tolerate such irritation. The insignificant benefit to be derived from such applications is enormously disproportionate to the chances that are taken of causing or hastening decubitus. Pain should be relieved by the administration of phenacetin, combined with one of the salicylates, and by morphin, which should not, however, be given hypodermatically. Involuntary twitchings of the lower extremities are best controlled by the latter drug, but when they are not very severe they can be mitigated by the occasional administration of a dose of one of the bromids. The fact that this latter drug is a vasomotor depressant, however, should not be lost sight of.

When the myelitis is due to blood diseases, such as anemia and leukemia, in brief, when there are grounds for the belief that the myelitis is in reality a myelomalacia, with secondary inflammatory reaction, the treat-

ment is somewhat different. In such cases the administration of eliminatives, the application of cold, and the giving of drugs that have any lowering influence upon the circulation are contra-indicated. We can judge of the existence of these conditions only from the history of the patient and the accompanying manifestations. Such patients require supporting, stimulating, and alterative treatment from the beginning. Active antisyphilitic treatment is at times of signal service in cases in which there is a distinct syphilitic history, especially if the treatment is begun early and carried out vigorously, that is, repeated arsphenamine injections *and* the use of mercury. The treatment must not be carried out in the beginning to the exclusion of treatment looking toward the restitution of the blood-vessels that are the seat of degenerative and exudative changes. The general treatment is the same as given above, but should include in addition small doses of cardiac stimulants, such as strophanthus and digitalis, combined with moderately increasing doses of iodid of potassium. If the myelitis is secondary to blood diseases, the treatment is the adoption of measures looking to the cure of the condition to which the myelitis is secondary, and the administration of substances that support the patient's vitality. The same may be said of myelitis occurring secondary to autointoxications. They are to be combated directly quite apart from the superadded occurrence of myelitis, but the latter is to be treated as well. It is unnecessary to enumerate the special indications of causal therapy in each one of these conditions.

In all cases care should be taken to brace the patient to withstand the onslaught upon his vitality and to maintain as far as possible the integrity of the peripheral circulation. The first is to be encompassed by careful administration of nutritious, easily digested food, given frequently and in small quantities, and if necessary by the administration of alcoholic stimulants in small quantities. The second can be accomplished in part by the application of dry heat to the lower extremities, by frequent and prolonged immersions of the extremities or the entire body in warm water, after which they are wrapped in cotton wool, and by the use of mild massage. It must again be mentioned that the vitality of the skin is such that it will resent rough handling of any kind, and care must be taken in the application of hot-water bottles and in the use of manual friction.

Electricity has been recommended for its attributed efficacy in mitigating certain symptoms, such as incontinence of urine, for preventing muscular atrophy, and for its direct effect upon the spinal cord. It may be stated positively that it should never be used with any such end in view as specific action on the cord. In some cases it would seem that a large electrode connected with the positive pole and placed above the pubes over the bladder and the negative on some indifferent point, while a current of from 2 to 3 m.a. is allowed to flow, is of some service. After

the acute stage has subsided, either the faradic or the galvanic current may be used to stimulate muscular contraction and especially to prevent inactive muscle atrophy. As a rule, it may be said that it is much safer not to use electricity during the acute stage.

In some cases, even in those in which the greatest care has been expended in carrying out the essential requirements in the treatment of every case of myelitis, namely, rest, cleanliness, frequent change of position, absolutely smooth surface to lie upon, tonifying measures, etc., untoward symptoms, such as cystitis, pyelitis, bed-sores, and other trophic phenomena, occur which require particular and careful treatment. Such treatment, however, is not at variance with the treatment applicable to similar conditions developing under other circumstances. Cystitis occurring with myelitis requires for its successful treatment a careful study of the urine, the administration of substances that make it as bland and unirritating as possible, and the local or intravesical application of substances that combat the inflammation. Frequent and thorough irrigation with plain warm water, or, better still, with some simple alkali and antiseptic solution, such as a 5 per cent solution of boracic acid, a 2 per cent solution of salicylic acid, or an extremely weak solution of nitrate of silver (1:1,000), should be used two or three times daily. Vesical irrigations with carbolic acid and sublimate solution have been recommended, but their virtues are not sufficient to counterbalance the discomfort and danger attending their use. Pyelitis is to be treated according to general principles of rest, administration of large quantities of water, and small doses of salol or urotropin, with the same attention to the diet as indicated in the ordinary case of pyelitis. Bed-sores are to be treated with antiseptic solutions and dressings the same as acute ulcers occurring in a debilitated subject. The danger in attempting to stimulate them to healthy reaction is great. When they cannot be controlled in this way, the patient must be put for a time in a continuous warm-water bath.

After the acute stage of the disease has passed comes the time for the adoption of measures looking to the absorption of the inflammatory residue and the mitigation of the consequences of the injury. The nutrition of the patient should be carefully studied. It is not only necessary to administer appropriate food, but to get the patient into the fresh air by means of an invalid roller chair if he is unable to walk, to administer measures that contribute to sleep, overcome constipation, and to maintain nutrition of the muscles and the integrity of the peripheral circulation by massage, passive exercise, and as much active exercise as it is possible for the patient to take. It is at such times and later that regular cures should be undertaken, either at home or abroad, at thermal springs and health resorts, such as the Hot Springs of Arkansas and Virginia, Glenwood Springs, Colorado, Richfield Springs, New York, Lamalou,

France, Nauheim and Oeynhausen, Germany, and such places as have obtained repute in the treatment of different varieties of degeneration of the spinal cord. A sojourn at one of these places frequently results in much greater benefit than can be explained by the taking of the waters internally or externally. It not infrequently improves the patients' morale; the observances there require the maintenance of great cleanliness, which in turn betters the peripheral circulation, and the disciplinary measures to which they are subject facilitate metabolism and increase the appetite. All of these are of the greatest importance. Many men experience a partial or temporary restoration of the sexual power from such treatment; this improvement benefits them by inspiring hope and imbuing confidence.

In cases of myelitis secondary to diathetic conditions this is the period when there is some hope of using constitutional and non-medicinal measures to great advantage. It is also the period when rigorous antisyphilitic treatment should be carried out if such treatment seems to be indicated, as it is in every case in which there is a syphilitic history, whether or not the patient has had what seems to have been adequate treatment following the infection.

As yet there is little to be obtained from serum therapy in most cases. Where a definite infectious agent is demonstrated as still active the vaccines or sera may be tried. In every case of myelitis of suspected gonorrheal origin the vaccines should be given. Thus far the results have been disappointing, but the trial of them has been wholly inadequate.

CHRONIC MYELITIS

Under the foregoing title the combined pseudosystem diseases of the cord will be discussed, as well as chronic myelitis proper. This has been made possible by the researches of Nonne, Henneberg, Mayer, and others, who have demonstrated that for the greatest part this group derives its origin from small foci in the various tracts. Nonne is inclined to confirm Leyden and doubts the existence of true combined system disease of the cord.

Etiology.—The causes of chronic myelitis are: (1) all the causes of acute myelitis, as the chronic variety may be one mode of termination of the acute; (2) syphilis, which is by all means the commonest single cause, it being found in at least one-third of all the cases, and has already been discussed; (3) poisons, such as ergot, which has the peculiarity of causing destruction, particularly of the posterior column, alcohol, lead, mercury; (4) auto-intoxications, gout, diabetes, and chronic anemia. The predisposing causes are practically the same as those of acute myelitis. Exposure to cold and wet is the attributed cause in many of them. Fa-

tigue and prolonged physical activity and strain are noted in many others. The disease is likely to occur during the years of early maturity, and much oftener in males than in females.

A variety of chronic myelitis dependent upon senile changes in the spinal blood-vessels, senile arteriosclerosis with resulting perivascular sclerosis, occurs occasionally in old age, and is known as senile paraplegia.

Of 40 consecutive cases diagnosticated as chronic myelitis, 32 were males and 8 females. The average age of the patients was thirty-seven years. Out-of-door manual laborers furnished 42 per cent of the entire number. Fourteen of the 32 patients gave a history of syphilis, and in 11 of these the symptom-complex of myelitis conformed to the type known as syphilitic spinal paralysis. Thirty-three per cent of the cases gave a history of exposure to cold, and in the majority of these the refrigeration was considered the cause of the disease by the patient. In 15 per cent of the entire number the disease was secondary to acute myelitis, and in the majority of these there was a history of acute infection, such as influenza or pneumonia, or of exposure. In 8 per cent of the cases there was a history of injury without evidence of its previous existence. One patient had diabetes and 2 suffered from severe and chronic anemia. Only 1 case was of the senile variety.

The symptoms of chronic myelitis which are sequential to the acute variety will depend very largely upon the severity of the original process. They are practically the same as those of acute myelitis, save that they are less profound. When chronic myelitis is chronic *ab initio,* as from exposure and exhaustion, the symptoms usually consist of: (1) heaviness and easily induced fatigue of the legs: (2) stiffness of the lower extremities in the beginning, particularly after arising and after resting, but later the stiffness is constant; (3) exaggerated tendon reflexes, that is, knee jerks, ankle clonus, Babinski and Oppenheim phenomena; (4) urinary symptoms, particularly manifested in difficulty in emptying the bladder, later incontinence; (5) impaired sexual capacity; (6) variable and inconstant sensory symptoms, consisting of objective numbness of the legs and feet, tension around the lumbar and lower abdominal regions, and occasionally paresthesia of different parts of the lower extremities. The symptoms of the senile variety are a gradual development of a slightly spastic paraparesis associated with mild vesical symptoms. These symptoms become more pronounced and oftentimes the arms present analogous but less marked symptoms. In some cases arteriosclerotic changes in the brain, similar to those responsible for the senile paraplegia, produce the symptom-complex of senile dementia or other symptoms of encephalomalacia.

Treatment.—The treatment of chronic myelitis divides itself into treatment of the syphilitic cases and the non-syphilitic. In the former the amount and duration of antisyphilitic treatment which the patient

will tolerate must be decided in each case, and this cannot be decided properly without study of the cerebrospinal fluid. Aside from this and the causal treatment of myelitis, mentioned in the discussion of the acute variety, the treatment consists in so arranging the patient's life that he is saved bodily and mental agitation and fatigue, that he is spared the injurious action of alcohol, tobacco, and narcotics, and that he is vouchsafed a life of intelligent rest and exercise. These, and the employment of agencies to meet the symptomatic conditions and measures to improve nutrition, constitute the entire treatment. As soon as the paraplegia reaches that degree of development that locomotion is difficult and fatiguing, the patient should be encouraged to get about in a roll-chair. Spasticity is to be combated by frequent warm baths of from ten to fifteen minutes' duration. Many patients receive benefit and much comfort by remaining in such a bath for an hour or even longer.

Electricity is of no service in influencing the course of the pathological process. If there is muscular atrophy, either from inactivity or of other origin, electricity may be used with some success to combat these conditions. But as a rule both the galvanic and the faradic current tend to increase the spasticity, and should not, therefore, be employed. Massage and passive exercises are much more useful. Massage not only improves the circulation and the nutrition of the parts, but, when combined with gymnastics, tends to preserve mobility and to facilitate voluntary movements.

Local treatment over the spine, such as the application of the cautery, counterirritants, vesicants, etc., and especially the former, are sometimes of service. Such treatment seems to be quite as important for psychical as for physical effects.

The general health is frequently bettered by the employment of a mild cold water cure and by massage. They have a beneficial effect per se, and they likewise benefit by making the patient feel that something is being done for him. The symptomatic treatment is the same as in acute myelitis. The condition of the bladder and of the skin should be made objects of special solicitude.

Combined Sclerosis of the Spinal Cord, Combined Pseudosystem Disease, Funicular Myelitis

The various designations of this condition represent the somewhat different views of the investigators as to its cause. It is usually associated with pathologic blood states, such as pernicious anemia or chronic anemia.

Etiology.—The etiologic factor is most probably toxic arising in the low state of vitality of the individual, and may proceed from various exhaustion-producing diseases. Lesion of the cord occurs frequently in pernicious anemia, and has been considered by some to result from the

anemia, although its absence in severe hemorrhagic anemias and hemophilic states seems to argue against this view. We believe it should be regarded as the effect of the same toxins causing the pernicious anemia. It is found in the acute form, sometimes in leukemia, but here it usually appears as a more or less severe meningomyelitis with small foci of lymphocytes scattered throughout the cord and leptomeninges. Various other causes have been indicated, such as exposure to cold and wet, exhausting labor for a long period of years associated with chronic gastric or intestinal disorders, chronic alcoholism, and chronic nephritis, although in this instance the low-grade changes in the blood-vessels are rather to be regarded as the cause. It is never found in the cachexias of tuberculosis or malignant diseases.

Pathology.—Macroscopically the cord may appear quite normal or only slightly shrunken, the cut surface showing small grayish sclerosed patches in the lateral pyramids and posterior columns. Microscopically we find small inflammatory foci in the ascending and descending tracts, usually the posterior columns, the lateral pyramidal tracts, direct cerebellar and Gowers' tracts, and sometimes the anterolateral ground bundles and the columns of Türck. It may be limited to small funiculi in the tracts, or may involve the entire tracts. There is almost invariably a zone of normal fibers around the gray matter, which also is usually intact. The meninges are only slightly affected, the roots never. The vessels may be nearly normal, or show hyalin degeneration, sclerosis, and thickening of all coats. The marginal portions of the cord are more severely affected.

Symptomatology.—The onset is often insidious, beginning with weakness of the legs, rigidity of the muscles, paresthesias, numbness, tingling, etc., and the disease may progress rapidly to complete disability within a few weeks, or it may take months to develop. We have seen one case in which the symptoms came on rapidly after direct transfusion, a procedure which had most remarkable effect upon an anemia considered primary. The symptoms will naturally depend upon the tracts affected most severely. The reflexes may be paradoxical, that is, knee and ankle jerks absent and Babinski and Oppenheim phenomena present, all may be abolished or all may be exaggerated; extension of the big toe on stroking the sole of the foot is usually present. Sensory disturbances vary from light hypesthesia to profound anesthesia of all qualities. Bladder and rectal functions are usually disturbed, but not always. There is always in the beginning some degree of ataxia, although it may consist merely in a slight unsteadiness of station. The eyes, pupils, and cranial nerves are unaffected.

The disease is recognized by the presence of a pathologic blood state or history of exhausting work and visceral disease, rather rapid course,

absence of luetic history, combination of spasticity and ataxia, absence of painful nerves, or tenderness.

The course is dependent upon the virulence of the causative agent. In severe pernicious anemias and leukemias the patient may live only a few weeks. In the chronic forms these patients may live for several years, but their low vitality renders them easy victims of any accidental infection. A few cases have been reported cured, where the symptoms appeared rapidly during anemia, and subsided upon the disappearance of the latter. It is questionable, however, whether they belong in this category.

The treatment consists in the early detection and eradication of the toxic factor if possible. The later stages should be treated as chronic myelitis in the manner described above. Oppenheim has recommended the X-ray to the spine in the leukemic states. We may attempt to modify the course of the disease by vigorous tonic treatment with quinin, arsenic, strychnin, and transfusion of artificial serum and normal salt solution. Unfortunately, these measures are not very successful.

THE PROGRESSIVE AMYOTROPHIES OF CENTRAL ORIGIN

The subject of progressive amyotrophies will include only those diseases that are characterized by chronic wasting beginning in certain muscle groups extending to different parts of the body, and caused by a degenerative process in the spinal cord. Until the advent of the present century the tendency still prevailed to classify these types according to the topographical distribution of the wasted muscles and to consider them as nuclear degenerations in the strictest sense of the word. Thus we spoke of the progressive spinal type, that is, Aran-Duchenne, the infantile familial hereditary type of Werdnig-Hoffman, the chronic bulbar palsy or glossolabiolaryngeal form and progressive ophthalmoplegia. The pathologic basis for these different clinical types was considered much the same, namely, a simple primary degeneration of the lower motor neuron which was limited strictly to this anatomic unit. Starting as a gradual decay of the cell the process spread to the dendrites and down the neuraxon to its termination in the contractile part of the muscle. Amyotrophic lateral sclerosis was always considered in connection with these diseases, because it combined two of the above types, that is, progressive muscular atrophy and bulbar palsy together with the syndrome of spasticity. Although this disease exhibited so many features of the nuclear degenerative types it was thought because of the degeneration of the lateral pyramidal tracts to possess a pathologic entity of its own. Within the last two decades, however, our conception of these disease states has undergone a very

decided transformation and we now base our ideas on a more definite knowledge of the pathology underlying them rather than on purely clinical pictures. Several factors have contributed to bring about this change, chief among which we believe to be the observations of clinical types identical with them, but based upon demonstrable toxic pathologic causes such as chronic lead poisoning, syphilis, etc. At the same time records were published of cases of apparently pure nuclear type which on autopsy showed diffuse degeneration in the brain and cord although no suspicion of involvement of these regions had existed during life. In fact many cases diagnosticated as progressive muscular atrophy because of distribution of the wasting, character of onset, rate of progression and lack of all other signs, have proved after death to possess lesions of the cerebrospinal axis quite indistinguishable from those of amyotrophic lateral sclerosis. The bulbar and ophthalmoplegic forms have also been found after death to show lesions not strictly nuclear in type.

The result of these observations has so influenced our conceptions of these clinical forms that now the accepted belief is that the pathologic process is a degenerative inflammatory lesion dependent upon some obscure toxin which may be exogenous or endogenous. The progress frequently depends upon the localization rather than upon the virulence of the toxin.

The progressive muscular atrophies occur under two very different auspices: (1) an acquired form; and (2) a family form. Formerly it was believed that the progressive muscular atrophies were acquired or accidental diseases. Then an hereditary form of spinal progressive muscular atrophy was described; a familial form of bulbar paralysis and of ophthalmoplegia, and finally a familial form of spinal progressive muscular atrophy. Gradually, however, it has become apparent that the columns of motor cells in the ventral portion of the cerebrospinal axis may be so defectively developed, or immaturely constituted—the result of heredity—that they readily succumb to the influence of endogenous or exogenous toxins in certain levels at variable times after the birth of the individual, varying from the first month up to the age of late maturity. When the cells of the lumbar enlargement are affected in early infancy and in more than one member of the family, we call the disease a family type of spinal progressive muscular atrophy, and the same when the cells of the cervical enlargement are diseased. Under similar circumstances, when the cells of the oblongata disappear, we call it the family type of progressive bulbar paralysis; and, when the cells of the motor oculi nerves atrophy, under similar circumstances, we speak of the clinical manifestations as a family form of ophthalmoplegia. In a treatise of this kind it is unnecessary to speak of all the clinical varieties of the progressive muscular atrophies in detail, so we shall discuss only the more important etiological features and the treatment of the different clinical types.

Acquired Spinal Progressive Amyotrophy

(*Type Aran-Duchenne*)

Before the recognition of syringomyelia, localized hematomyelia, and chronic poliomyelitis, and before the time that intraspinal tumors were differentiated, it was believed that this variety of progressive muscular atrophy was much more common than it is now known to be. That it is the rarest of spinal cord diseases is conceded by all. Few, if any, have shown a willingness to follow the lead of Marie, who states that the disease has in reality no existence; for, after all of the conditions that are capable of giving rise to a similar symptom-complex are excluded, there still remains a small number of cases in which the diagnosis of progressive muscular atrophy due to destruction of certain groups of cells in the ventral spinal cord must be made. The symptoms that attend the development of such decay in these cells will depend upon the groups of cells involved and upon the severity of the morbid process. It has previously been said that the disease is primarily located in the majority of cases in the lower cervical region. This causes an atrophy of the muscles of the hand, principally of the interossei, the thenar and hypothenar eminences, which allows the hand to assume gradually a typical clawlike appearance. The atrophy extends to involve the muscles of the forearm, the shoulder girdle and arm, and, later still, the musculature innervated by the motor cells of the oblongata. The atrophy may finally involve the trunk and lower extremities, pointing to the implication of corresponding cornual cells. The muscular atrophy is attended by fibrillary twitchings which are severe in proportion to the severity of the trophic process. The unopposed muscles pass into a state of more or less contracture, depending upon the rapidity of the atrophy in the affected part, and there is functional inability of a part or an extremity proportionate to the degree and extent of the contracture. If the trophic process is a rapid one, there is true reaction of degeneration to the faradic and galvanic currents in the neuromuscular apparatus; but, if it is slow and insinuating, as it is usually, the electrical reactions are quantitatively diminished, or there is only partial reaction of degeneration. There are no other symptoms save those attributable to and dependent upon the depreciation of vitality and nutrition which is coexistent with the disease.

The course of the disease is progressive, but not uniformly so. It develops in an insinuating way, and continues by irregular exacerbations until it renders the parts absolutely functionless. Then the force of the disease seems to be spent, but after a variable time evidences of involvement of contiguous or remote groups of cells appear, and the symptoms thus induced continue until the respective part becomes useless. All this

time the vitality is gradually impaired, until finally, through a continuance of this, or through the advent of some infectious process in the muscles, the functioning of which is necessary that vital processes may go on, the patient succumbs.

Etiology.—The causes of this variety of the disease are unknown. It occurs more often in men than in women, and especially during the years of mature adult life. It has been attributed to recent and remote injury, both of the parts that show the atrophy and of the spinal cord; but it is unlikely that trauma has any determining influence, nor has exposure to cold. The occurrence of the disease has likewise relationship to the infectious fevers and to some of the metallic poisons, especially lead.

Syphilis was considered of no etiologic importance in the disease, but the Wassermann reaction has been found positive in a number of clinically pure types by ourselves and Spiller. Dana also found a history of syphilis in 33 per cent of his cases. It remains to be determined whether these are instances of true syphilitic affection of the anterior horns or the result of syphilitic disease of the anterior spinal artery. Suffice it to say that in every case both the blood and the spinal fluid should be carefully studied for evidences of syphilis.

Treatment.—The treatment of acquired spinal muscular atrophy is a forlorn chapter in therapeutics. There is an impression abroad that the disease can be brought to a standstill by the use of strychnin given hypodermically in large doses. To a certain extent our own experience corroborates this view. We have had under observation for sixteen years a patient in whom the atrophy seems to have come and remained at a standstill after such treatment, combined with the use of faradic electricity, massage, and general hygienic measures. We have treated 2 other patients in the same way with encouraging results. But it has failed in most other cases. The nitrate is the preferable salt to use, and it should be given in from 1/80 to 1/60 gr. and gradually increased until the dose is brought up to ⅓ gr. depending upon the results which attend its administration, and continued for a period of from two to four months. If symptoms of improvement do not follow such a trial it should be discarded, except as it may be used to meet certain symptomatic indications. Apart from this nothing has been recommended that approaches specific medication. The most important measures in the treatment are rest of the muscles that are beginning to atrophy, the use of electricity and massage to prevent the superimposition of inactivity atrophy, and the maintenance of a high degree of nutrition by regulation of the diet, exercise, hygiene, rest, and sleep, and the general state of the patient's bodily and mental health. So far as the causal therapy is concerned, it goes without saying that there should be at once a cessation of the occupation under the auspices of which the disease developed, and, if any relationship can be traced between infectious diseases or intoxica-

tions and the occurrence of the disease, medicinal measures should be taken to counteract and overcome them. The uselessness of electricity and massage in the treatment of progressive muscular atrophy is unswervingly contended for by some, but it is the experience of most physicians and our own that, when used with moderation, they are agencies of considerable value in delaying the progress of the disease. Massage is more serviceable than electricity. In using massage only the gentlest kneading movements should be employed. A very weak faradic current should be applied daily to the affected muscles for about five minutes. The danger is that too strong a current will be used. If the faradic current does not cause any response, the galvanic current should be used, both to redden the skin and to cause very slight contraction in the muscles. The real danger from the use of electricity lies in the exhaustion produced in the already severely affected muscles, and, unless it can be mose skillfully applied, its use should be avoided entirely. To maintain the general nutrition use must be made of mild forms of tonic hydrotherapy, of exercise, of tonifying medicines, such as arsenic, iron, small doses of mercury, and iodid of potassium.

Cacodylate of sodium in doses of from ¾ to 3 gr.—gm. 0.016 to 0.195—hypodermically every day for twenty doses has been warmly recommended. Whatever effect it has is purely tonic in character, since it exerts no direct influence upon the course of the disease. It is best administered daily for twenty doses, then withheld for a similar period. Given in alternation with strychnin nitrate, it often has a remarkably tonic effect and is well worthy of consideration in every case.

The animal extracts have been recommended, particularly extract of the thyroid gland, but the published experience seems to be decidedly against it. Change of climate, the visiting of various health resorts, and sea voyages, all of which are not infrequently advised, are useless, save as they may contribute to the maintenance of the patient's morale and courage. Unlike its opposite, tabes, or progressive degeneration of the peripheral sensory neuron, whose progress is almost invariably hindered by persistent, indefatigable treatment, progressive muscular atrophy is not infrequently accelerated by anything approaching active treatment. It remains to be said, therefore, that the results of treatment should be carefully watched, and, if the disease is progressing, all attempts at treatment directed specifically to the atrophic process should be interdicted, while the therapeutic efforts are centered in maintaining the general health.

Infantile Family Hereditary Amyotrophy

In contrast to the rare occurrence of the Aran-Duchenne type in members of the same family, Werdnig and Hoffman both described an hereditary form which appears in children and usually affects more than one

member of the family. The pathology of the disease is in most respects that of the other spinal forms and consists in progressive symmetrical nuclear degenerations with diffuse changes in the pyramidal and adjacent tracts. There is thus far no recorded observation which explains the peculiar hereditary or familial feature, but it is interesting to note that recently instances have been observed in this country and England of the occurrence of this disease and myatonia congenita in different members of the same family; which means, that an hereditary, progressively fatal disease of certain components of the cord and one we have always considered as a congenital non-fatal, non-hereditary disease of an entirely different system may appear independently in the same stock. The Werdnig-Hoffman type is characterized by onset during the first year of life, and by muscular atrophy which is essentially similar to the progressive spinal type. The atrophy always appears first in the muscles of the pelvic girdle or trunk, then spreads to the shoulders. The ileopsoas and quadriceps femoris are particularly affected, fibrillary twitching is absent, but contractures with subsequent postural defects, such as scoliosis and equinovarus, are frequently seen. Bulbar symptoms are rare, and, though the disease resembles in some respects the primary myopathies, hypertrophy or pseudohypertrophy have never been noted. The course of the disease is from one to six years and always ends fatally either by interference with the muscles of respiration or from secondary infection.

Chronic Progressive Bulbar Paralysis

(*Labioglossolaryngeal Paralysis*)

Clinically this disease consists, as its name implies, of a paralysis of the lips, tongue, and larynx, causing a destruction of some or all of the functions of these parts, associated with atrophy, particularly of the lips and tongue. Anatomically it is dependent upon a progressive atrophy of the motor nuclei in the ventral portion of the oblongata. The clinical phenomena of the disease are gradual disturbance of articulation, characterized by slowness and indistinctness; difficulty of mastication and of swallowing; in brief, difficulty in executing any of the movements subserved by the musculature supplied by the ninth, tenth eleventh, and twelfth nerves. The inability to close the mouth and to pucker the lips gives to the lower half of the face a characteristic expression, while the atrophy of the lips and tongue, accompanied by fibrillary contractions, is apparent to the eye and to the touch. As the disease progresses, the manifestations of labial and lingual prehension, articulation, mastication, swallowing, and laryngeal activity become more and more impaired, while evidences of encroachment upon the lateral nucleus of the pneumogastric are manifest by attacks of cardiac palpitation and syncope. There are

no sensory disturbances. The electrical excitability of the muscles is the same as in the spinal form of progressive muscular atrophy. The actual causes of the disease are unknown. Like progressive spinal muscular atrophy, the disease occurs in individuals who have put the musculature supplied by the peripheral motor neurons of the oblongata to exhaustive use, and the degenerative changes in these neurons are the natural successors of exhaustion. Thus the disease has been observed in glass-blowers, buglers, and cornet-players. Progressive bulbar paralysis is a rare disease at any age, and particularly so in the young, except the familial form, which will be referred to later. Occasionally it is seen in advanced life. The disease occurs about one-third more frequently in males than in females, and the cases observed in females develop at relatively a more advanced age. Factors which are often held responsible as causative of degeneration in other parts of the nervous system, such as rheumatism, syphilis, and gout, cannot be claimed as etiological factors in this disease, it being rare to find that the poison of these diseases has ever found a foothold in the system; nor can it be said that the disease is closely associated with degeneration of blood-vessels, aside from the fact that it commonly occurs at an epoch when arteriosclerosis usually takes place.

The exciting causes are, first and most important, overexertion, particularly of the mouth and vocal apparatus, fright and anxiety, enervating habits, exposure to cold, and all forms of depraving influences. Theoretically, it is considered that toxic factors may be operative in some cases, but the only proof of such that can be advanced is one of analogy. In a few cases, however, it has been observed that the disease occurred after lead poisoning, diphtheria, and influenza. But in considering these cases it must be kept in mind that many of them were reported at a time when the symptom-complex now described under bulbar neuritis was unknown. Occasionally degenerative bulbar palsy seems to develop secondarily to acute inflammatory bulbar paralysis, just as progressive muscular atrophy seems now and then to follow many years after a poliomyelitis of infancy. Not infrequently progressive bulbar palsy is merely an extension upward of the degenerative process that is causing spinal progressive muscular atrophy and amyotrophic lateral sclerosis, and conversely lateral amyotrophic sclerosis may begin as the bulbar type. A gliomatosis of the central canal extending into the fourth ventricle and the development of a tumor in the oblongata may likewise cause the syndrome of bulbar palsy. Very rarely the formation of an islet of multiple sclerosis or a number of them in the ventral portion of the oblongata may cause this syndrome.

The duration of the disease is a very variable one. Some cases run a uniformly progressive course, and terminate fatally within one or two years. In other cases the course of the disease is characterized by periods of improvement, or at least by remission of some of the distressing symptoms. Such remissions are temporary, and do not influence

the eventual fatal outcome, although they may add to the patient's days and comfort. Very rarely, probably never, does the progress of the disease come to a standstill. The course is essentially chronic, and month after month the gradual increase in the intensity of the symptoms, notwithstanding the most assiduous treatment, is lamentable and discouraging. It is uncommon for the disease to take more than from three to four years to run its course, but occasionally it lasts more than twice that length of time. The immediate cause of death is universal exhaustion, death occurring from heart failure, attacks of syncope, or inhalation pneumonia; foreign substances, principally those taken for alimentation, pass into the larynx and into the respiratory passages and cause strangulation and suffocation, bronchopneumonia and localized pulmonary gangrene.

Treatment.—Although this disease leads uniformly to a termination which no therapy is able to avert, and although oftentimes our most strenuous efforts to delay the fatal outcome are negative, nevertheless, in the majority of cases, not only can the patient's comfort be contributed to, but his existence materially prolonged by assiduous and proper treatment. The real causation of the disease being unknown, it is impossible to speak of causal or prophylactic treatment other than to say that occupation or injurious indulgences that may possibly have any influence upon the disease should be interdicted and avoided. The most important factors in the treatment of chronic progressive bulbar paralysis are the maintenance of the patient's nutrition and the securing of as nearly as possible complete rest to the muscles that are undergoing atrophy. A semisolid and liquid diet should be adopted from the beginning, and this of the most nourishing kind. Milk and its various preparations, eggs, raw or slightly boiled, the most concentrated meat soups and nourishing gruels, should form the principal part of the dietary. The amount of force required to masticate and swallow meat and the consequent exhaustion more than counterbalance any benefits to be derived from it. The proteids, although important energizing agents and tissue builders, are not so urgently required as to warrant giving them in the shape of meat that must be chewed and swallowed. Proteids that admit of being given in liquid or in semisolid form fulfill every requirement. Careful diet lists should be prepared and the form of food changed with sufficient frequency to prevent the patient from tiring of it. It is a mistake to consider that a larger amount of food than is necessary to keep up the patient's weight is of any considerable benefit. It is advisable to remove dry breadstuffs early from the dietary, as they are most liable to enter the glottis and provoke severe attacks of spasmodic coughing. Semisolids are swallowed with greater ease than liquids. As soon as swallowing The diminished sensibility of the palate and vault of the pharynx which becomes especially difficult, resort should be had to the feeding tube. these patients have during the later stages of the disease contributes to

the ease and comfort with which the tube can be passed. It cannot be too strongly emphasized that this mode of feeding should not be left until the patient is absolutely incapable of making deglutitory efforts. This mode of feeding may often be supplemented by limited rectal alimentation. As a rule, all forms of alcoholic drinks are harmful in this disease. Their ingestion tends not alone to make the patient more uncomfortable by contributing to palpitation of the heart and flushings, but they have a depressing after-effect, which is very bad. Any beneficial influence they have to stimulate the nutrition is easily obtained from the administration of a mildly alcoholic or non-alcoholic malt extract. The same may be said of tea and coffee; cacao, however, is a nutriment of real value. The patient should be prevented from using his voice with the same scrupulousness as in pneumonia. The early formation of the habit of communicating desires and thoughts graphically can only be advantageous and it is to be commended. Feeble efforts to dislodge food that gets between the teeth and cheeks by the tongue, as well as all other unnecessary movements performed by the labioglossolaryngeal musculature, are to be deprecated.

The two therapeutic measures which can be made use of by the physician with the best prospects of affording some relief are electricity and strychnin. Various ways of applying the former have been advised. Any benefit to be derived from this procedure is obtained through its preservative influence on the degenerating muscles, and not in any way on the degenerative process in the oblongata. Therefore, passing the galvanic current from one mastoid process to another, or galvanization of the cervical vertebral column, is not advocated. The use of the constant current to cause slight contraction of the muscles of the face, tongue, lips, and pharyngeal muscles, and to cause artificial swallowing movements for a few minutes each day, is the electrical procedure that is advised. As in all such degenerations, the danger is that too much rather than too little electricity will be given. The electrical treatment should be kept up every day for two months, each séance lasting for from five to ten minutes, and then an estimate taken of its effect. Particular warning must be given against the use of the galvanic current in this disease without a rheostat and milliamperemeter, since the same rule applies to the already exhausted muscles in this instance as in the spinal form. The patient's comfort and well-being are frequently contributed to by a moderate amount of general faradization, and by the use of massage. We have never been able to convince ourselves that massage of the atrophying parts was of the slightest service, but general massage, if given with sufficient mildness, may exercise a tonifying effect on the nutrition. Although the beneficial effects of strychnin are never so apparent in this disease as they are occasionally in its analogue, progressive muscular atrophy of spinal origin, yet it is the most satisfactory vascular and muscular tonic

available in chronic progressive bulbar palsy. It should not be given hypodermically. In many cases it can be advantageously combined with small doses of morphin, especially when the patient complains of dyspnea. The morphin, given in doses of 1/30 to 1/15 gr. twice a day, acts as a reliable cardiac stimulant, while it exercises a soothing effect upon the patient's mind. The latter effect is well manifest in the relief of the dyspnea, which is almost always partly psychical. The use of iodid of potassium, mercury, and the salicylates, with the idea of specific and alterative action, as has been recommended by some writers, is a fallacy. Unless a history of comparatively recent syphilis or rheumatism can be obtained, or unless the serological findings indicate their employment, such drugs are harmful. Nitrate of silver, phosphate of zinc, and ergot have been used extensively, but they cannot be recommended.

Aside from steadying the nutritive balance by restoratives and aids to digestion and guarding the patient against factors that produce excitement or depression, the treatment is symptomatic. The patient should lead a quiet, uneventful life, as free as possible from strife, worry, and anxiety. Exercise in the open air, in moderation, is essential, but care is to be taken that it is not carried to the point of fatigue. The utilization of an occasional course of mild cold-water treatment for its tonifying effects and to keep up the patient's general nutrition is advisable. The symptoms that not infrequently require particular treatment are drooling, coughing, dyspnea, syncope, cardiac palpitation, and hysterical types. Drooling is not so common a symptom as might be inferred from reading some of the older authors, but occasionally it is not only depressing and exhausting to the patient, but very annoying to those about him. It is but slightly influenced by belladonna and its alkaloid, or by any other medication save morphin. As it is not advisable to give the latter in quantities sufficient to affect the secretion, the drooling must be combated by absolute quiet of the patient. When, however, it seems to be very exhausting, no hesitation should be had in the use of morphin for a few doses. Attacks of spasmodic coughing, which are usually due to the entrance of foreign particles into the air passage, owing to incomplete closure of the glottis, are oftentimes a most annoying and exhausting symptom. It can be relieved temporarily by the administration of medicines that tend to blunt the sensation of the larynx, such as the bromids and morphin. But there is some danger in using these substances. The spasmodic cough is nature's signal that foreign substances are attempting to enter the respiratory passages. If the sensibility of the laryngeal mucous membrane is blunted, the entrance of such foreign substances may be unsignaled, and lead up to the occurrence of "swallowing" pneumonia. Despite this, small doses of morphin or cocain must oftentimes be used to combat the symptoms, but during their administration extra caution must be had in the feeding of the patient.

Dyspnea, syncope, and cardiac palpitation are all in the beginning of the disease partly psychical, and more may be accomplished for their amelioration by suggestion and by assurance that these symptoms are of no significance than by the administration of drugs. However, the effects of a cold water compress or ice-bag over the heart, the administration of a pungent aromatic cardiac stimulant, such as ammonia or ether, may be partly psychical as well as physical, and beneficial for both reasons. Hysterical attacks superimposed upon bulbar palsy are most distressing to witness, and extremely exhausting to experience. The treatment that is applicable to them does not differ from that which is serviceable in hysterical attacks occurring without organic disease. It has not seemed to me that the hysterical attacks have added to the gravity of the disease in 2 patients with chronic bulbar progressive paralysis, who have been for a number of years under observation.

If paralysis of the vocal cords or the entrance of foreign substances into the respiratory passages makes suffocation imminent, one should not hesitate to perform tracheotomy.

Family Form of Chronic Progressive Bulbar Paralysis.—The familial or hereditary variety of chronic progressive bulbar paralysis has been recognized only within recent times. It is apparently very infrequent, even compared with the variety just described. It occurs under practically the same conditions as the infantile and familial forms of spinal progressive muscular atrophy. It occurs in infancy and during the developmental years of life, and has no particular symptomatic features, aside from the ordinary form, save a participation in the atrophy and paralysis of the upper facial musculature. This is especially true of the cases of familial bulbar paralysis detected in infancy. Familial bulbar paralysis in the adult would seem to be unattended with involvement of the upper facial, but it has the unusual complication of muscular atrophy, especially of the muscles of the neck. As in chronic degenerative progressive bulbar palsy, the disease is a progressive one toward a fatal ending, but the course of the disease is oftentimes very slow, from ten to twenty years elapsing before the termination. The course of the disease is apparently uninfluenced by treatment, save in general and symptomatic indications pointed out for the idiopathic form. These should be followed out as consistently as possible in this form. The infantile familial variety is not infrequently superimposed upon the spinal variety of progressive muscular atrophy, or a forerunner of the former, and the treatment for the one is likewise the treatment for the other.

Amyotrophic Lateral Sclerosis

The nosological relationship of amyotrophic lateral sclerosis to the progressive muscular atrophies has already been spoken of. This disease

is characterized by the symptoms of progressive muscular atrophy of the Aran-Duchenne type, complicated with bulbar involvement, plus spastic paresis, particularly of the lower extremities, and exaggeration of the tendon jerks all over the body. The symptoms of spasticity usually precede those of atrophy, and it is therefore believed that implication of the terminations of the central or corticomotor neurons antedates that of the peripheral motor neurons. That this is so is shown not only by the occurrence of spastic symptoms before the trophic symptoms, but by the fact that, when cases come to autopsy, the morbid process in the central motor neurons which can be traced to the motor cortex gives every evidence of having been complete for some time, while that in the peripheral motor neurons is in progress. Although occasionally the disease is accompanied by pathological changes in other parts of the cord, such as degeneration of the posterior columns, as a rule the symptom-complex does not include any disturbances of sensibility or of the cutaneous reflexes, or disturbance of the functions of the bladder or bowels. The absence of such symptoms bespeaks the limitation of the disease process to the anterior horns and pyramidal tracts.

There are several features of amyotrophic lateral sclerosis which appear in sharp contrast to the picture of the Aran-Duchenne type. They are: the ordinarily rapid rate of progression; the more extensive distribution of the atrophy in which the shoulder girdle or pelvic girdle is more affected than the hands and feet; and lastly the wide distribution and coarse character of the fibrillary twitching.

The causation of the disease is practically unknown. From analogy and from inference, particularly those based upon the findings in cases studied microscopically, it is believed that the anatomical basis of the disease is conditioned by some chronic intoxication acting through the vascular system. The forces that determine the involvement of the terminations of the central motor neurons and the beginnings of the peripheral motor neurons can only be conjectured. Such injurious influences as hereditary disposition of ganglion cells in different parts of the cerebrospinal axis to undergo decay without adequate cause, manifested by the occurrence of nuclear or neuronic diseases in the collateral ancestry; exhausting overwork of the extremities; trauma to one of the extremities or to the spine; vascular depravity following repeated exposure to cold, intoxications, and infections appear to operate as the exciting cause, but we cannot prove it. It occurs in males and females with equal frequency, and develops ordinarily between the thirtieth and fortieth year. Occasionally the onset of the disease is rather abrupt and the patient succumbs in from twelve to eighteen months. As a rule, however, symptoms develop insidiously and the course of the disease averages from two to three years. It may, however, last much longer. It has been observed by Déjerine for sixteen years, and by Flourod for ten years.

There is a well-established familial variety of amyotrophic lateral sclerosis, which, like all other familial disease of this class, occurs in childhood and pursues a very chronic course, being oftentimes stationary for a number of years.

Treatment.—The treatment of amyotrophic lateral sclerosis is practically the same as that for chronic myelitis, in addition to the general measures that are of service in maintaining the nutrition spoken of under spinal progressive muscular atrophy. No drug medication has the slightest effect upon the course of the disease. The intensity of the spasticity may be somewhat decreased, and the suffering engendered by this condition mitigated by the use of prolonged lukewarm baths, in which the patient may remain for from two to four hours out of the twenty-four. The crippling of the patient through the spasticity and contractures that occur in the unopposed muscles after atrophy has become well pronounced can be overcome to some extent by the persistent use of active and passive gymnastics, but oftentimes the annoyance and fatigue attending such indulgence more than counterbalance the slight beneficial effect. Marburg very properly warns against division of the posterior roots for the relief of spasticity or contractures in these cases. When the morbid process invades the oblongata, the symptoms of bulbar paralysis should be treated in the same way as has already been mentioned under that caption. The same care must be expended upon the feeding, and all that this implies, that is necessary in true bulbar paralysis. The entire treatment of amyotrophic lateral sclerosis may be summed up in a word: make the patient as comfortable as possible. For patients who can afford it, this is most satisfactorily accomplished by providing them an intelligent nurse. Those who cannot should seek the shelter and care of a hospital. Despite this gloomy view of the treatment of amyotrophic lateral sclerosis, the physician should not despair. It is not too sanguine to expect that nature has provided a remedy to check the disease if it can be found and applied before the neural constituents, the decay of which forms the anatomical basis of the disease, have perished. This is surely true if the pathogeny of the disease is the result of some chronic intoxication. If the disease is a teratological defect, a disease of involution, it is idle to search for such a remedy.

Asthenic Bulbar Paralysis

Asthenic bulbar paralysis, myasthenia gravis pseudoparalytica, bulbar paralysis without anatomical foundation, are the designations given to a class of cases in which the symptoms in their entirety resemble very closely chronic degenerative bulbar palsy, and in which after death—a termination to which the majority lead after a variable time—examination of the motor neurons as well as of other systems of the body fails to reveal any striking departures from normal.

Nothing is known of the causation of the disease. Of the cases reported the majority have been under the age of thirty, although it does appear during middle age and even later. It has been observed in a patient with profound chlorosis. The possibility that it is dependent upon a chronic intoxication of endogenous, or possibly of exogenous, origin has been suggested.

There is much in the irregular course of the disease as it manifests itself in some patients that lends color to the view that it is dependent upon injurious agencies, the source of which is within the body. Various agencies have been regarded as etiologic factors. In many cases an enlarged thymus has been found, in others diseased parathyroids, in one case adenoma of the hypophysis. As the disease frequently exhibits symptoms referable to disturbed thyroid secretion, a relationship between the two has been sought. Disturbances of calcium metabolism, ammonia excretion, and creatinin excretion have been frequently observed.

The symptoms usually develop slowly. The patient may have complained for an indefinite time of easily induced fatigue and a feeling of overpowering exhaustion after comparatively slight effort. The development of the symptoms may, however, be rapid, so that the disease reaches its height in a few weeks. Frequently the initial symptom that attracts the patient's attention is ptosis of one or both sides. The ptosis may appear first on one side, then disappear, and the upper lid of the opposite side becomes affected, or it may occur on both sides simultaneously and be associated with paresis of some muscles supplied by the oculomotor nerve, such as the internal or superior rectus. Following this, or going before, there occur weakness of the muscles of mastication, paresis of the lower part of the face, and defect in articulation and in vocalization, which is associated with paresis of the abductors and adductors of the vocal cords. The voice becomes nasal, talking tires the patient and quickly exhausts his capacity in this direction. The lips are unwieldy and there may or may not be paresis of the tongue; swallowing is difficult or impossible, fluids regurgitate, and the soft palate is lax and responds very sluggishly to mechanical irritation. General weakness with a feeling of exhaustion in the trunk and extremities, true myasthenia of all the motor parts of the body develops symmetrically, at the same time with or after the bulbar symptoms. In exceptional cases the weakness manifests itself first in the arms, extends to the legs, and eventually shows itself in the cranial nerves. As the disease progresses, and this it may do with considerable rapidity, respiratory and cardiac symptoms become very distressing and foreshadow dissolution. The course of the disease is irregular, made up of periods of remission and improvement and of periods in which the functions of the motor and sympathetic nervous systems are profoundly impaired. The manifestations through

the sympathetic nervous system are practically those of shock and they are irregularly periodic in occurrence.

In contrast to true bulbar palsy the muscles preserve their volume, at least there is no true degenerative atrophy. Electrical irritability of the neuromuscular apparatus is preserved, but frequently exhausted after brief excitation, and irritability is not regained until after prolonged rest. There are no fibrillary twitchings of the muscles of the face and extremities, and the deep reflexes are present, but, like the electrical irritability of the muscles, their excitability is quickly exhausted and recovered only after rest. This is known as the myasthenic reaction and is an important aid in distinguishing the disease from others that simulate it, such as the bulbar form of disseminated sclerosis and poliencephalitis superior. There are no disturbances of sensibility, either objective or subjective, and the special senses are unaffected, although all of them become speedily fatigued. Digestion is impaired and normal intestinal activity is handicapped by lack of muscular tone. There is no drooling; the sphincters are intact; and the psychic faculties are unimpaired. The shortest duration of any recorded case is six months. We had under almost daily observation a typical case for upward of eleven years.

Treatment.—Complete and absolute rest to all parts of the body, the eyes, the tongue, the throat, and the extremities, is the most important factor. Restoratives and the careful and judicious use of measures to maintain a high state of nutrition, while at the same time every precaution is taken to prevent unnecessary expenditure of energy and bodily waste, will be followed by the best results. Artificial feeding by means of the stomach tube should not be resorted to, as the movements of regurgitation caused by the passage of the tube are more exhausting to the patient than is the act of swallowing artificially masticated and liquid food. Oppenheim warns against the use of electricity for the purpose of causing muscular contraction, but recommends central galvanization. The usefulness of the latter has been corroborated by Goldflam, who reports the recovery of 4 patients. In the treatment of 1 case which has been very successful, central galvanization with a current inducing the weakest possible contraction of the muscles manifesting the asthenia was employed.

If it is borne in mind that in this disease all the voluntary muscles, and especially the oblongata musculature, are in such a state that slight stimulation soon exhausts them, it will not be necessary to warn against the incautious use of strychnin, massage, and electricity, the three most available muscle tonics. All of these may be employed if intelligence directs their use. Strychnin should be given in extremely small doses, while its effects are carefully watched, and the moment it produces any feelings comparable to fatigue and exhaustion after its physiological effects have worn off the dose should be materially diminished. It is most useful when symptoms of inefficiency of the sympathetic nervous system

are conspicuous. Another drug used to good advantage under like auspices is the salicylate of physostigmin in from 1/100 to 1/40-gr. doses. Massage and galvanic electricity may, we believe, be used to advantage if care and attention are given to their application, and if they are given in sufficiently small dosage.

There is no specific diet to be recommended. Excess of carbohydrates, calcium in large quantities, and albumin have been tried, but with little success. Recently considerable attention has been paid to the ductless glands. Administration of suprarenal substance, spermin, thyroidin, hypophysis, and ovarian substances have all been employed with no relief, and, on the contrary, the condition has often been made much worse. Extirpation of the thymus when persisting has been recommended, but never tried. X-ray exposures over the thymus have also been of no avail.

Chronic Progressive Ophthalmoplegia

When the ganglion cells in the ventral portion of the pons undergo disease changes similar to those constituting the pathology of progressive muscular atrophy and progressive bulbar paralysis, the result clinically is bilateral atrophy and palsy of the external muscles of the eye, to which the name chronic progressive ophthalmoplegia is given. Like the other forms of progressive muscular atrophy, there are nosologically two varieties—the hereditary infantile form and the acquired idiopathic form. The acquired variety is the more common. The pathological change underlying it is similar to that of chronic bulbar paralysis and chronic progressive muscular atrophy, and it may complicate or be complicated by either of these two conditions, particularly the former. The variety of bulbar paralysis that is associated with chronic progressive ophthalmoplegia is, however, not so typical clinically as the uncomplicated variety. The same is true for progressive muscular atrophy of the Aran-Duchenne type. In other words, when the brunt of the lesion is borne by the cells of the pons and the oblongata, or the pons and the cervical cord, the resulting degeneration is neither so severe nor so extensive as it is when the pathological changes are confined exclusively to one of these segments. It would almost seem that the cause of the pathogenetic process when distributed over a larger area was insufficient to produce destruction of all the cells in a given area.

Chronic progressive ophthalmoplegia occurs under about the same auspices as the other two varieties of progressive muscular atrophy that have been described. It is most liable to develop in persons from twenty to forty years of age, and somewhat more often in males than in females. Intoxications and infections, as well as traumatism and exposure to cold, have been held responsible in some instances, but their relationship to this disease is no closer than is their relationship to the other progressive

muscular atrophies. This, in truth, is very insignificant. It is more than likely that some of the cases that have been reported as occurring after diphtheria and poisoning by the minerals, such as lead, were dependent upon a rudimentary form of neuritis of the oculomotor nerve. It occasionally develops in syphilitic individuals who are benefited by the administration of antisyphilitic remedies, and thus this infection is considered of some causal importance. It is most commonly a complication or integral part of some other disease, such as general paresis, locomotor ataxia, multiple sclerosis, and the progressive muscular atrophies already mentioned.

The disease is evidenced clinically by the gradual and progressive occurrence of functional disability of the external muscles of the eyes which progresses until these muscles are completely powerless, usually associated with a slight or moderate degree of ptosis. The initial symptom is diplopia, but the patient soon unconsciously suppresses one of the images and depends upon monocular vision, so that after the disease has lasted for a time the patient does not complain of seeing double. The internal eye muscles are usually spared, but they may be involved to a considerable degree. The diagnosis can readily be made by process of exclusion.

The congenital variety is invariably associated with lack of development and functional incapacity of the facial nerve. This form of the disease is akin to the familial varieties of bulbar and spinal atrophy, that are supposed to be dependent upon incomplete development or atrophy of the respective nuclei. The course of the disease in this variety is apt to be more stationary and is sometimes associated with evidences of hypoplasia of other parts of the central nervous system.

Treatment.—Less can be done in the treatment of chronic progressive ophthalmoplegia than in any form of progressive muscular atrophy, and for the simple reason that we are unable to apply the measures, such as electricity, massage, and rest, that have some capacity to delay the progress of the atrophy in other varieties of progressive muscular atrophy. Unless there be some specific causation of the disease, such as syphilis or metallic intoxication, that allows of specific medication, efforts at treatment are limited to maintaining the general nutrition of the patient, and advising complete rest of the muscles involved. Strychnin does not seem to be of any use, except as a general tonic, nor do arsenic and iodid of potassium. When the disease occurs as a forerunner or concomitant of other diseases, such as have been mentioned, treatment must be directed toward opposing them.

MUSCULAR DYSTROPHY

The term muscular dystrophy is applied to that form of atrophy in which the primary changes are in the muscles themselves, in contradistinction to ordinary progressive muscular atrophy, in which the atrophy is secondary to disease of the ventral horn cells of the spinal cord, or the peripheral motor nerves. Formerly the progressive muscular atrophies and dystrophies were not differentiated, but so soon as it began to be recognized that the former were almost invariably acquired diseases of adult life, and that the latter were either family or hereditary diseases, occurring in infancy and early adult life, the distinction began to be made. In latter years the tendency has been to draw the line of separation very closely, from an anatomical standpoint, between the progressive muscular atrophies and the dystrophies. The result is a more or less widely disseminated belief that in the dystrophies there are no pathological changes in the spinal cord. As a matter of fact, it is highly probable that in every case of the latter affection there are secondary changes throughout the entire peripheral motor neurons, especially after the disease has existed a long time.

Anatomically the progressive muscular atrophies may be classified, according to the segment of the peripheral motor neuron that is affected, into myelopathies, neuropathies, and myopathies, according as the cell body, the neuraxon, or the intramuscular ending is primarily involved. In muscular dystrophy the lesion in the beginning is in the intramuscular nervous substance. The pathological changes that are found in the neuraxon and in the ventral horn cells are secondary and have nothing to do with causing the phenomena of the disease.

Formerly a number of clinical varieties of muscular dystrophy were described and much energy was devoted to the establishment of differentiations between the types; but to-day it is fully recognized that muscular dystrophy is a distinct disease subject to variations in the time of its development, in the groups of muscles which are affected, and, to a less important degree, in its clinical features. Separation of the clinical forms of the disease is of no service, save as it may facilitate prompt recognition of the disease and thus indirectly contribute to an estimation of the course and prognosis.

Many clinical types of progressive muscular dystrophy are described but we shall refer only to the three important ones. These are as follows:

1. Pseudohypertrophic paralysis, which occurs in early childhood, more often in males than in females, and which shows itself first in the lower extremities, especially the calves, by apparent hypertrophy of these and other groups of muscles, associated, however, with loss of strength,

The enlargement of the muscles is due to a progressive lipomatosis which goes on at the expense of the muscular fibers and a myosclerosis. The disease then extends to the trunk, especialy to the muscles of the sacro-lumbar region, and gives rise to a characteristic gait, station, and mode of assuming the erect posture from a recumbent one. Later the upper extremities become affected, especially the muscles of the shoulder girdle and upper arm, and, as a rule, these muscles atrophy without undergoing a preliminary spurious hypertrophy. The muscles of the forearm and face are spared until very late in the course of the disease. As the disease progresses the apparently hypertrophic muscles shrink proportionately to the completeness of the fatty transformation and myosclerosis.

Leyden and Möbius individually called attention to a form of muscular atrophy that resembles this type in every respect save that the dystrophy is not attended with any considerable pseudohypertrophy. Some writers have endeavored to create a special type to which these clinicians' names are attached, but happily without success.

2. A facioscapulohumeral type, to which attention was first specifically directed by Landouzy and Déjerine. The atrophy, as the name indicates, reveals itself first in the face, especially in the orbicular muscles of the eye and mouth, which gives a peculiar cherubic expression to the countenance, known as the myopathic face and tapir mouth. It then extends to the shoulder girdle and arm muscles, very rarely to the lower extremities. This variety of dystrophy is not associated with any manifestations of pseudohypertrophy. It occurs in early childhood and occasionally at any time up to the period of adolescence.

3. A juvenile form, which has been particularly studied by Erb, and first reveals itself about the time of puberty, and has a distribution very similar to the facioscapulohumeral type, although the primary manifestation of atrophy is almost invariably in the shoulder girdle, while the face is involved later. Occasionally there is a slight degree of pseudohypertrophy accompanying the development of this form.

The table on page 276, taken from Sachs, shows the comparative similarity and differences of these three forms of the same disease.

Treatment of the Dystrophies.—The inefficiency of therapeutic measures to cope with muscular dystrophy is in a large measure explainable by the fact that we are dealing with an evolutionary defect in the muscles, and, as there is very little borrowing from art to lend to nature, very little can be accomplished in delaying the progress of the disease after it has once become manifest, nor is there any way of preventing the disease except by the voluntary renunciation of procreation by those whose ancestral and collateral family histories show this disease. It should be kept in mind that not all of those whose ancestry or family reveals the existence of dystrophy develop the disease. Many of them do not. It

Types of Primary Dystrophies

	Muscular Pseudo-hypertrophy	Juvenile Form of Progressive Muscular Atrophy, Erb's Type	Type Landouzy-Déjerine
Part first affected.	Legs (calves).	Shoulder girdle.	Face and shoulder girdle.
Distribution of hypertrophy.	Calves, rarely thighs.	Muscles around shoulder girdle and pelvic girdle.	None.
Distribution of atrophy.	Thighs, deep muscles of back, shoulders and scapular muscles. Calves during later period; at that time also general atrophy.	Thighs, deep muscles of back, upper arm. Hypertrophied parts may become atrophic in later stage.	Face muscles, including lips and orbicularis palpebrarum; shoulder and scapular muscles.
Parts remaining normal.	Face, forearm, and hand.	Face, forearm, hand and leg muscles, except in last stages.	Forearm, hand, and legs, and deep muscles of back.

is in such individuals that great care should be had that no strain or excess be put upon the neuromuscular system, which might awaken to reality the dormant dystrophic tendency. As muscular dystrophy in all its clinical varieties is a disease of infancy and early youth, it need not be said that these precautionary measures are to be taken particularly during the early years. It goes without saying that individuals who are afflicted with the disease should not marry. Those whose immediate family history shows the existence of the disease should be warned of the danger of reappearance of muscular dystrophy in their descendants, even though they themselves remain entirely free from it. Such individuals should be urged to remain unmarried, and, if they are married, to remain childless. If they insist on marriage, great care should be taken to point out their obligation to choose a mate that will, by means of healthy antecedents, tend to overcome the handicap and at least give a fair proportion of healthy children. As a matter of fact, the physician rarely has the opportunity of advising or applying prophylactic treatment except in those instances in which some member of the family is already under treatment for this disease. In such a case the apparently healthy children should be carefully instructed in the development of their muscular systems by systematized exercises. The difficulty is to choose a happy medium between overexercise, which might arouse the latent tendency to the disease, and insufficient exercise, which might allow the muscles to fall into a state of inactivity atrophy. The general care of such an individual should be directed to maintaining a supreme degree of nutrition.

After the dystrophies have begun to develop something can always be done, and often a very great deal can be accomplished in delaying the course of the disease by the proper utilization of gymnastics, massage, electricity, proper dietary and hygiene, and the coöperation of the orthopedic surgeon. All writers are seemingly in accord that systematic exercise is the most important measure. A few cases have been reported in which it would seem that the progress of the disease had been brought to a standstill by the use of this measure alone. It is impossible to say, except in a general way, what form of gymnastic indulgence will be beneficial in a given case. It depends somewhat upon the clinical type of the disease, upon the stage of the disease, and upon the age of the patient. As a rule, it may be said that some form of resistance exercise, carefully graded, particular care being taken not to put too great resistance upon the atrophied muscles or groups of muscles, is the most beneficial. It has the advantage that it may be employed in very young children who cannot be taught ordinary gymnastics. Although the cases that have been reported in which systematic active and passive exercise was followed by considerable benefit are of the facioscapulohumeral type and the juvenile type, theoretically there is no reason why it would not be as available in the pseudohypertrophic group. In these latter cases, unfortunately, the apparent hypertrophy is often taken by the family and by the physician to indicate excessive muscular development, and the disease is not recognized until it has passed into the moderately advanced stage of lipomatosis and myosclerosis. Then usually much time is wasted in desultory application of electricity before systematic exercise is begun. The truth is that up to date the most important measure in delaying the progress of muscular dystrophy is systematic exercise, and the sooner it is begun the greater is the prospect of improvement. The hazard attending its use is that it may be overdone. The physician should be content with comparatively slight results even after the expenditure of prolonged treatment.

Electricity is of very slight service in the treatment of the dystrophies. This may be explained in part by the fact that it is rarely applied as methodically and persistently as should be done to make legitimate estimate of its capacity to delay the atrophy. In muscular dystrophy the electrical reaction is quantitatively diminished in keeping with the degree of degeneration of the muscular fiber. There is no true reaction of degeneration. This, of course, allows the galvanic or faradic current to be used so as to produce muscular contraction, and such muscular contraction, if brought about carefully and without much intensity, is theoretically of service to prevent inactivity atrophy, and it may be of some use in delaying the specific atrophy. The greatest care must be exercised not to overdo the application of electricity. A few contractions in the atrophied muscles produced once or twice daily are far more ad-

visable than a prolonged séance. The slowly interrupted faradic current is more advisable than the galvanic, especially in the early stages of the disease. The galvanic current has the advantage of stimulating the local circulation more than the faradic, and it may, therefore, be legitimately alternated with the former. The effects of electricity to improve the local nutrition are much more definitely obtained by the use of massage, which should be applied in the shape of very light muscle kneading to every case of muscular dystrophy. In the utilization of these three measures, exercise, electricity, and massage, sight should not be lost of the fact that in the interval of their application the patient should be as nearly as possible at complete rest. Nothing can be more injurious than the attempts of patients to drag themselves about when the lower extremities are the seat of muscular dystrophy, or to use the upper extremities in some occupation when the disease is of the juvenile type. This should not be construed to mean that the patient should not be in the open air, and under auspices that contribute to general tonification of the muscular system. The aid of the orthopedic surgeon should be sought just as soon as deformities arising from contracture of unopposed muscles interfere with the getting about of the patient. Such contractures should be overcome by partial or complete tenotomy and the parts retained in an approximately normal condition by the use of that prosthetic apparatus which is indicated. Winged scapulæ, if caused by serratus paralysis, may be anchored to the ribs by means of wire, etc., and a fairly useful arm obtained. Occasionally some such apparatus may be beneficial in giving support to the parts that are not deformed by the contracture.

Recent biochemical studies of cases of muscular dystrophy appear to indicate a disturbed carbohydrate metabolism because of a fairly constant: (1) Creatinuria; (2) hypocholesterinemia, and (3) a delayed glucose utilization. This has led many to consider the disease of endocrine origin resulting from disfunction of several endocrine glands with consequent imbalance of the glycogenesis-glycogenolysis mechanism. On this basis McCrudden and Sargent treated a case with pituitrin and adrenalin and obtained remarkably beneficial results. Our own experience with these substances as well as with thymus and thyroid extract has not led us to be very enthusiastic over the success of this form of treatment, although in certain early cases, an arrest of the progress of the disease may be obtained.

In brief, the treatment of the muscular dystrophies consists in the employment of those physical measures that are known to tonify the muscular system; in the adoption of dietary and hygienic means that serve to maintain general nutrition, and the adoption of measures that overcome deformity and contribute to the comfort of the patient.

Neural Progressive Muscular Dystrophy

(*The Peroneal or Leg Type of Progressive Amyotrophy*)

This variety of progressive amyotrophy has been studied especially by Charcot, Marie, and Tooth, and is not infrequently referred to by the names of one or all of these investigators. After the disease was first described it was contended by many writers that the morbid process was predominantly, if not exclusively, a degeneration of the nerves with secondary involvement of the spinal cord, particularly the columns of Goll, Clarke's columns and occasionally the ventral cells; but at the present time there can be no doubt that the so-called "neural form" of progressive muscular atrophy is dependent upon different anatomical processes. In some cases it is primarily a disease of the peripheral nerves, while in other cases it is wholly probable that the pathological changes occur simultaneously in the spinal cord and peripheral nerves, or even primarily in the cord. The clinical picture of this variety of the disease, it may therefore be said, does not depend upon an individual pathologico-anatomical foundation.

The symptoms of the disease are, it may be readily inferred, subject to variation in kind, in intensity, and in course. As a rule, the muscular wasting begins in the musculature of the peroneal nerves, and is manifested by the gradual occurrence of club-foot. Occasionaly the atrophy shows itself first in the upper extremity, especially the small muscles of the hand and the extensors and flexors of the forearm. Wherever the primary manifestations of the atrophy may be, it may extend to any part of the body. In a case recently reported by Siemerling, in which the initial muscular atrophy was of the thighs and the hands, there eventually developed loss of the pupillary reaction, nasal speech, tremulous voice, in addition to an extreme degree of paretic atrophy of the forearms and entire lower extremity. The distinguishing clinical features between this form of progressive muscular atrophy and the spinal form are the sensory disturbances which are never absent, and the more complete reaction of degeneration in the atrophied muscles to the electrical current. The causes of this disease, aside from the fact that it is a family affection, are entirely unknown. It usually begins during the early years of life, almost invariably before the age of puberty, and pursues an extremely chronic and irregular course. That there are exceptions to this rule is shown by the fact that Oppenheim and Cassirer have reported a patient in whom the disease began in the forty-second year, and Egger has described the disease as it occurred in two brothers, aged respectively thirty-three and thirty-eight years of age. The male sex is affected oftener than the female. The customary attributable exciting causes, such as ex-

posure, intoxications by lead, alcohol, and syphilis, as well as the inherited diminished capacity of resistance of the nervous system, are spoken of in the etiology of the disease, but practically nothing is known of its real causation save that it is a family affair.

Treatment.—The treatment of this form of progressive muscular atrophy calls for the measures that have been enumerated in discussing the treatment of progressive muscular atrophy of spinal cord dependency and the progressive muscular dystrophies. The fact that all family nervous diseases pursue a much slower course, and are oftentimes characterized by more or less prolonged cessation of the apparent activity of the disease, affords opportunity for the use of electricity, massage, and gymnastics looking toward the retardation of the morbid process and the changes in the muscles. The fact that the disease usually begins in the feet and the legs, causing some variety of club-foot which seriously cripples the patients, prevents them from getting the exercise and indulging in some of the pleasures of life that might otherwise be afforded. These deformities should be subjected to the same kind and grade of orthopedic treatment as similar deformities arising under other conditions.

MYOTONIA CONGENITA

(*Thomsen's Disease*)

The name myotonia congenita is given to a peculiar family disease first described by Thomsen, a Silesian physician in whose family more than 20 cases occurred. It is characterized by the occurrence of chronic contraction in all the voluntary muscles on attempt at innervation or movement, while at rest the neuromuscular system appears to be quite normal, save for the hypertrophy of the muscles which always exists after the disease has lasted for some time. The disease is classified as a family affection, but that it is not always familial has been proved by a number of recent reports. The hereditary factor in its causation may be manifest as a direct transfer from an ascendant or indirectly by inherited disposition. The predisposition to its occurrence may be atavistic. Jacoby, among others, has shown that the symptom-complex of the disease may occur independently of neuropathic heredity, developing after acute infectious diseases, such as typhoid fever and diphtheria, and transitorily after depraving influences, such as prolonged exposure to cold. He suggests that the names myotonia acquisita and myotonia transitoria be given respectively to these forms of the disease. On the other hand it has frequently been reported in combination with tetany. Von Orzechowski has evolved three groups from the cases hitherto published. They are: (1) single myotonia symptoms with complete tetany syndrome; (2) formes

frustes of the myotonic syndrome with formes frustes of the tetany syndrome; and (3) well-developed myotonia with single tetany signs.

This relatively frequent combination of manifestations of these two diseases has encouraged Von Orzechowski, Lundborg and others to consider that the pathology of myotonia was based on a primary hypoparathyrosis. As Barker points out, the possibility of endocrine disturbances in acquired myotonia, the familial occurrence and pathologic constitutional make-up in many cases of tetany with myotonia speak for an endocrine disturbance in Thomsen's disease. Von Orzechowski has even attempted to explain this variability by a theory of reciprocal suppression, but for the present, while we are in possession of enough facts to assume that the tetany signs in this combination are due to parathyroid disturbances, we are still in the dark as far as the pathogenesis of the myotonia features are concerned.

Myotonia congenita usually manifests itself in the early years of childhood, or at least before puberty, and frequently under the immediate auspices of fright, shock, or mental excitement. The essential feature of the disease is the occurrence of tonic spasm in the voluntary muscles on attempt at purposeful movements, and the inability of the patient to relax this tonic condition by force of the will. At the end of from fifteen to thirty seconds the contraction relaxes spontaneously, and, after several repeated attempts at motion followed by a similar tonic spasm to a lesser degree, the patient is finally able to perform such purposeful movements, and for a long time, as walking, running, and dancing. The muscles present a characteristic mild tonic reaction constituted of normal mechanical, faradic, and galvanic irritability of the motor nerves, and increased irritability of the muscles. These, combined with absence of all symptoms pointing to a gross involvement of the nervous system, go to make up the essential feature of the disease. As in most neuropathic conditions, the occurrence of this disease is not infrequently associated with other symptoms pointing to an unstable nervous system, such as psychical symptoms, epilepsy, and migraine.

It is very doubtful that the disease can be looked upon as a congenital abnormality of the neuromuscular system, particularly in light of the fact that acquired and transitory forms occur. It would seem more legitimate to postulate an inherited or familial instability of this system which can be called into active morbidity by factors arising from within and without the individual. Such an instability of the neuromuscular system may also be acquired. In the congenital form very little can be done to prevent this instability, but much may be done to delay the advent of its manifestations. The patient whose birthright entails the potentiality of this disease should be advised concerning the selection of an occupation or profession, and concerning the questions of marriage and propagation. He should be warned against those indulgences and habits

that have a tendency to increase the irritability of the neuromuscular system. Such are strains, exposure to excessive cold and heat, excesses in eating and drinking, mental excitement, and the like. It should be made known to such patients that a quiet, uneventful life may be full of usefulness to themselves and others, and the existence of their disease need not necessarily shorten their allotted days. No treatment has so far been suggested that is of any service in overcoming the manifestations of the disease, save the adoption of measures looking toward this kind of an existence. Naturally, electricity, massage, gymnastics, and Swedish movements have all been thoroughly tried. They do not seem to have any particular beneficial effect. Some physicians have claimed that they have noted amelioration of the disease from the use of massage and graduated gymnastic exercises, but the consensus of opinion is that they are of very slight service. In the acquired form causal therapy should be employed in addition to the general measures already mentioned.

SPASTIC SPINAL PARALYSIS

Both Erb and Charcot long ago described a clinical entity characterized by slowly progressive rigidity of the lower extremities, with exaggerated tendon jerks, and called it primary lateral sclerosis. It is extremely rare, so rare, in fact, that its very existence has been denied by many authors, but Erb's justification lies in the published reports of Strümpel, Déjerine and Sottas, Minkowski, Nonne, and others. It occurs predominantly in males, appearing usually in the third decennium, although it has been seen at a much later period, and is so slow in its development that its progress is barely perceptible. The disease itself is not fatal; these patients always die from some intercurrent disease, and it may last until the senile period of life appears.

Primary lateral sclerosis is more nearly a monosymptomatic disease than any other in neurology, and is characterized by an insidiously progressive rigidity of the legs. These patients first realize that their gait is not so brisk and active as formerly. On arising after remaining seated for any length of time, they are stiff and perhaps a little awkward, which soon passes off after exercise. They become fatigued after long walks, and begin to experience difficulty in mounting or descending steps. From then on there is chronic intensification of this condition, until the gait becomes slow, with short, shuffling steps, pronounced adduction of the thighs, the toes catching in slight obstacles. Objectively there are marked resistance to passive movements, exaggerated tendon reflexes, patellar and ankle clonus, Babinski phenomenon, and Oppenheim reflex, that is, extension of the great toe when the thumb or a blunt instrument is drawn from above downward along the inner surface of the calf with considerable pressure.

The abdominal and cremaster reflexes are lively and never absent. There are no sensory disturbances, the bladder and rectum functionate normally, and there are no trophic disorders. Various forms of the disease have been described, but it is doubtful whether they really belong to the picture of true primary spastic paralysis. That the arms may be affected, and exhibit true muscular rigidity with increased tendon jerks, is probably the case. When one leg is more affected than the other, the corresponding arm is also more spastic (Oppenheim). Strümpel and others have described spastic bulbar symptoms, spasm of the larynx, and emotional disturbances, but we should always accept these forms with reserve, since we are more apt to be dealing with disseminated sclerosis or amyotrophic lateral sclerosis. This is also true of the various sensory disturbances described, except possibly the aching pains apt to accompany muscular rigidity.

The diagnosis is made from consideration of the slow progression, rigidity, and exaggerated reflexes. It may sometimes be confused with multiple sclerosis, when the latter begins insidiously with few symptoms, except rigidity and exaggerated tendon jerks. In the latter instance, however, the irregular progression of events, remissions, and absence of abdominal reflexes will serve to differentiate it from primary lateral sclerosis. It can be distinguished from beginning amyotrophic lateral sclerosis by the rapid progress and appearance of bulbar symptoms and atrophies in the latter. Before making the diagnosis of primary lateral sclerosis, one must be careful to exclude all residua of previous lesions, such as trauma, hemorrhages, transverse myelitis, cerebral infantile diplegia, etc. It is perfectly possible to find a low-grade spasticity persisting years after recovery from the above-named conditions, and a careful inquiry into the early life of these individuals will nearly always establish this fact.

The pathogenesis has never been demonstrated in a satisfactory manner; although the most reasonable hypothesis is that the myelinization of the pyramidal tracts, because of faulty development or congenital weakness, gives way earlier in the individual's life than the other systems. It is unable to withstand the demands of an ordinarily active life.

Pathology.—Our knowledge of the pathologic process in these cases has been contributed to by Erb, Strümpel, Déjerine and Sottas and Spiller. The membranes are normal, the cord is usually of normal volume, and the cut surface shows normal color except in the lateral pyramidal tracts, where a grayish sclerosis becomes apparent. Histologically we find a simple descending degeneration in the lateral pyramidal tracts with low-grade neuroglia increase. The degeneration begins below the pyramidal decussations, sometimes in the cervical, sometimes in the dorsal, regions, and persists throughout the length of the tracts. In the absolutely pure cases the degeneration was limited to the lateral pyramidal

tracts. In Déjerine and Sottas' case there were a mild degeneration in Goll's tracts in the lower dorsal portion and a pallor of the direct cerebellar tracts. The vessels are normal, except in the sclerosed tracts, where they show a simple sclerosis.

Treatment.—We are as yet quite helpless in controlling or arresting the progress of this disease, and we must fall back on attempts to check its progress, regulate the life of the patient, and make him as comfortable as possible. Toxic doses of strychnin sulphate have been employed with no success. Iodid of potassium has no influence upon its course, and silver nitrate, gold chlorid, and the colloids have been of no avail. On the other hand, we should insist that these patients avoid fatiguing walks, should not be exposed to exhausting temperatures, cold or damp atmosphere. Alcohol and tobacco, in moderation only, and simple, wholesome food is the best diet. If the rigidity is very annoying and a tendency to contractures exists, prolonged—forty-five minutes to one hour—warm baths at 100° F. will give the most relief. Massage and passive exercise will maintain the nutrition of the spastic muscles, and give relief from the ache that so frequently accompanies this condition. Coarse vibration to the spine, setting up exercises, or severe manipulation may improve the circulation and afford temporary relief. It is always best to explain carefully to these patients the mechanism of their gait, and show them how in part it may be overcome by exaggerating every joint excursion. We have often seen as much improvement in the gait of these patients after practice in this as from any other measure.

SYRINGOMYELIA

Syringomyelia is a disease of the spinal cord and oblongata, characterized clinically by an association of motor, sensory, and sympathetic symptoms, closely simulating tabes plus progressive muscular atrophy, and anatomically dependent upon cavity or fissure formation predominantly of the gray matter. The cavity or fissure of the cord may be single or multiple. It varies in diameter from a mere slit to an opening sufficiently large to admit the end of the little finger. Longitudinally it may extend throughout the greater part of the spinal cord, but it is more often confined to one or a few segments. The hole or slit or fissure or whatever it may be does not preserve the same shape throughout its entire course, nor does it occupy relatively the same position in different segments. The cervical cord is most commonly the seat of cavity formation, and after this the upper cervical region with the lower third of the oblongata. The lumbar segments are the next most common seat, while the dorsal segments are rarely involved—that is, by a cavity that confines itself to these segments, it being borne in mind that it is not at

all uncommon to find holes in the dorsal cord in connection with cervical or lumbar cavities. When the syringomyelia is of the cervical segments the gray matter is usually rather uniformly encroached upon, while, when the cavity formation is of the lower dorsal and lumbar region, the posterior horns and posterior columns are oftener involved and there is relatively less encroachment upon the anterior gray matter. A very curious fact is that the anterior cornua never seem to be exclusively affected, nor are the anterolateral columns, although the corresponding parts of the posterior half of the spinal cord are frequently exclusively affected. The area of special predilection of cavity formation in the oblongata is the ascending root of the trigeminal nerve and the vagoglossopharyngeal-hypoglossal nucleus.

Syringomyelia is by no means a pathological entity. The cavity may be a congenital condition existing in the shape of an enlarged central canal. In some such instances the possessor goes through life without any apparent evidences of its existence. Such a condition must, however, be a locus of diminished resistance wherein inflammatory or degenerative changes may begin. The hole in the cord constituting syringomyelia may be due to a gliomatosis resulting in the formation of a glioma which has predominantly longitudinal extent, or it may be caused by a proliferation of glia tissue and consequent destruction of the parenchyma; or the inclusion of embryonal tissue during the development of the posterior commissure and the obliteration of the dorsal portion of the neural tube may well furnish a nucleus for such subsequent pathologic growth. It would seem to be definitely proved that cavity formation may be the result of hemorrhage into the substance of the cord, which, acting by cleavage in the direction of least resistance, causes the formation of an empty space after the coagulum has been partially or completely absorbed. Syringomyelia has been found associated with chronic pachymeningitis and leptomeningitis, with chronic myelitis, especially with the form known clinically as lateral sclerosis, and with other organic diseases. Just what relationship these morbid conditions have to the syringomyelia has not been determined. Occasionally it has been found coexistent with hydrocephalus, atrophy of the cerebrum and cerebellum, and with congenital conditions, such as spina bifida.

Very little is known of the etiology of the disease. Although of recent recognition, its occurrence is by no means very uncommon. Men are afflicted more often than women. A neuropathic history is the rule, and the disease has been encountered in several members of the same family. It is associated sometimes with such functional nervous diseases as exophthalmic goiter, hysteria, chorea, neurasthenia, and Raynaud's disease, but it is highly probable that these conditions are merely expressions of an encroachment by the cavity formation upon the sympathetic nervous system representation in the spinal cord. The most important

attributed exciting factors are trauma and the infectious diseases. Just how these act, except to favor the occurrence of gliosis or gliomatosis and hemorrhage into the substance of the cord, it is impossible to say. Some authors have laid particular stress upon dystocia as an exciting cause. But it must be extremely uncommon, and when it has any influence is through producing rupture of intramedullary blood-vessels. The infectious diseases, such as typhoid fever, pneumonia, and malaria, may likewise act to produce degenerative changes in the blood-vessels, which predispose to intramedullary hemorrhage and thus to cavity formation. Syphilis plays no rôle in the etiology of the disease, although syringomyelia occasionally occurs in syphilitic patients. The endeavor has been made by some physicians to establish the nosological identity of syringomyelia and anesthetic leprosy, but very little success has attended such efforts.

Symptoms.—The typical symptom-complex of syringomyelia is progressive atrophy of individual muscles or groups of muscles, associated with a widespread partial sensory paralysis, manifesting itself as analgesia and thermo-anesthesia, with fully preserved tactile sensibility, and with trophic manifestations, especially of the skin and of the bones. The seat of the atrophy will depend naturally upon the location of the cavity in the cord. Usually it is of the upper extremities and face. If the cavity is in the lumbar region, the atrophy will be of the lower extremity. The muscular atrophy is dependent upon a destruction of the ganglion cells of the peripheral motor neurons. When the cells constituting the common origin of the vagus, glossopharyngeal, and hypoglossal nerves in the oblongata are encroached upon, there will be muscular atrophy and other disorders indicative of the partial or complete destruction of these cells. The motor and sensory manifestations of the disease may be entirely or predominantly unilateral, or they may be bilateral. The dissociation of sensibility—that is, the occurrence of thermo-anesthesia and analgesia with preservation of tactile sensibility and of the muscular sense—although not absolutely pathognomonic, as it may occur with tabes, hematomyelia, Pott's disease of the cervical region, hysteria, and divers forms of multiple neuritis, is by far the most constant symptom. If the lateral columns of the cord are encroached upon by the cavity formation, there will be rigidity and paresis of the extremities corresponding to the location of the cavities. The state of the deep reflexes will also depend upon whether or not this part of the cord is involved. If the group of cells from which spring the neuraxons supplying the muscles of the front of the thigh are encroached upon, the knee jerks will be absent. On the other hand, if they are not, and the lateral columns are affected, the knee jerks will be increased. In the atrophied muscles the electric contractility is diminished in proportion to the degree of atrophy, but true reaction of degeneration is exceptional. Oculopupillary mani-

festations, consisting of retraction of the eyeballs and narrowing of the palpebral fissure, and inequality of the pupils (Schultze eye of German writers), are very common and usually unilateral.

The trophic symptoms vary enormously in different cases. They consist of softness and pultaceousness of the skin, of such eruptions as erythema, eczema, and pemphigus; and of ulcerations, gangrene, and alteration in the nutrition of the nails. The cellular tissue may be the seat of phlegmon, abscess, and lacerations. The joints are sometimes the seats of indolent arthropathies, especially the shoulder, similar to those of tabes, and the spinal column is usually the seat of scoliosis or kyphoscoliosis. The more common vasomotor and secretory symptoms are dermographism, edema, cyanosis, and increase in the secretion of the salivary, lacrimal, and sweat glands. The sphincters and sexual functions remain intact.

A symptom-complex, known as Morvan's disease, is identical with syringomyelia. It consists of muscular atrophy and weakness of the upper extremities developing simultaneously with analgesia or anesthesia, extending over the arms, and associated with the occurrence of panaritium on the fingers, which leads to deep-seated ulceration and often to crumbling of the terminal phalanges.

The fact that anesthetic leprosy sometimes produces a syndrome very similar to that of syringomyelia has already been mentioned.

Treatment.—The treatment of syringomyelia consists essentially in protection from harmful environment, support of general body health by hygiene, hydrotherapy, and tonics, and by rigid control of and careful attention to the different deformities and trophic disturbances.

These patients should be warned against exhausting exercises, especially of the arms and neck; overexertion causing undue strain of the cardiac muscles. They should be carefully instructed concerning the sensibility disturbances and taught how to protect these parts against blows, extreme heat or cold. As hemorrhages into the cavities are apt to occur, they should be warned against sudden exertion, and also against joint strains, on account of the liability to arthropathies. It is well to have them always test hot water, hot bottles, etc., with normal parts before allowing the anesthetic areas to come in contact with these articles.

The general bodily health is best maintained by a simple, wholesome diet, out-of-door life, tonic baths, light exercise, and rest. CO_2 baths have been recommended for their stimulating effects. If there is much pain, caffein citrate, gr. i (gm. 0.065), antipyrin, gr. ii to v (gm. 0.13 to 0.30), dionin, gr. ¼ to ½ (gm. 0.016 to 0.032), pyramidon, gr. ii to vii (gm. 0.12 to 0.5), either singly or in combination, are helpful. Gentle passive stretching of the painful nerves has been advised. Mechanical apparatus should always be employed for this purpose. The milder cutaneous irritants, the violet ray for ten minutes to the painful area, chloroform liniment, or vibration by one of the commercial machines,

may prove efficacious. Suspension should never be employed, likewise lumbar puncture, unless absolutely necessary for the diagnosis, since the danger of hemorrhage is too great to warrant their employment. If there is severe spasticity, prolonged warm baths and passive movements are serviceable. Of the tonics, arsenic, strychnin, and ergot have received most attention. We have never seen actual benefit from the last-named drug. Arsenic, either in form of Fowler's solution, gtt. v to x, t. i. d., or arsenious acid, gr. 1 to 50 (gm. 0.002 to 0.065), t. i. d., or daily hypodermic injections of cacodylate of soda, gr. ¾ to 1 (gm. 0.048), is of service in maintaining general tone. Strychnin sulphate has been often tried, but with uncertain results. One case was apparently arrested for at least eight years by the accidental administration of an almost lethal dose. The patient emerged from a night of convulsions with apparently no ill effects, and never as long as he was under observation displayed any evidences of progress. If given, it should be administered hypodermically, daily increase in the dose to the point of tolerance.

Ten-minute exposures of the spine to the X-ray have been recommended, but we should always bear the possibility of burns in mind. Radium baths have been recommended by Schlesinger, also ten-minute to one-and-one-half-hour exposure to radium rays but our own experience with this form of therapy has proved so barren of success that we have abandoned its practice. Even with the modern massive dosage it is difficult to conceive of a penetration through the bony structures sufficient for therapeutic effect on the soft tissues of the cord.

In carefully selected cases where a history of suddenly developing signs of transverse lesion of the cord seems to indicate a hemorrhage into a preëxisting cavity or a sudden increase of pressure of fluid within the cavity, surgical intervention may be warranted. If the above-mentioned conditions exist, and the segmental level is favorable, benefit may reasonably be expected by laminectomy, incision and drainage of the syringomyelic cavity. Cases of this type have been reported by Kennedy, Taylor and others.

The care of the trophic disturbances is mostly mechanical and surgical. Arthropathies should be protected by various orthopedic devices whenever support is needed; suppurations in the joints should be freely incised and attempts at ankylosis encouraged. Ulcers, perforating or otherwise, should be treated surgically, and care taken to prevent spread of the necrotic process. Operative measures are only to be undertaken after all other mechanical means have failed. We should always wait for spontaneous healing of ulcers and infected joints, since this is not at all uncommon. Bier's hyperemic method has been used successfully a number of times in the treatment of ulcers. Joints that are prone to subluxation should be protected wherever possible, and even arthrodesis may be necessary in the habitual cases.

MULTIPLE SCLEROSIS

Multiple or disseminated sclerosis appears in early adult life—in the second or third decennium—but may begin in early childhood, and has even been observed as late as the forty-fifth year. The disease was formerly considered to be relatively infrequent, and, as regards the classic type described by Charcot, this is still true. Within the last two decades, however, numerous abortive forms (formes frustes of the French), atypical forms, and variations from the original type have been described, and the disease has taken a front rank in the order of frequency of neurological diseases. It is considered by most writers to be next in frequency to tabes dorsalis.

Etiology.—Unfortunately we know little of the causative agents of the disease. It is very frequently seen after acute infectious diseases—typhoid, influenza, scarlet fever, measles, pertussis, cholera, acute articular rheumatism, and malaria. It has developed after pregnancy and metallic poisoning of lead, zinc, tin, and manganese workers. Trauma and severe colds also have a place among the etiologic causes. In the majority of cases, however, it is impossible to find a single cause, and we are forced to rely on Strümpel's theory of endogenous intoxication. Ziegler has spoken of an abnormal disposition to glia hyperplasia in these individuals. Much has been said recently concerning the bacterial etiology, chiefly by Simons, Marinesco, Gye, Kuhn and Steiner. Kuhn and Steiner found a spirochete similar to the leptospira of Weil's disease. Teague, however, as a result of probably the most comprehensive study of the subject as yet undertaken, reported in 1921, to the Research Association in Nervous and Mental Diseases, that he was unable to corroborate these findings and could find no evidence of a bacteriological causative factor.

Symptoms.—The classic type described by Charcot consists of stiffness, weakness of the legs, muscular rigidity, exaggeration of reflexes, Babinski and Oppenheim phenomena, hurried action of the sphincters, absent abdominal reflexes, tremor of the hands, usually intentional in character, ataxic movements of the hands, scanning speech, disturbances of vision, and nystagmus. In a great number of cases there are irregular patches in the optic nerves with contraction of visual fields and scotoma. The onset may be abrupt, with convulsive moments and unconsciousness, and these so-called apoplectiform attacks may occur during the disease. The mentality is in some cases severely affected, and may be confused with general paresis. There is very often emotional disturbance that may be taken for hysteria. All forms of sensory disturbances may be present, objective such as the Brown-Séquard type of dissociation, or subjective such as visual and auditory hallucinations, but the characteristic

feature of these disturbances in multiple sclerosis is that they are constantly changing, sometimes from day to day, in an almost kaleidoscopic fashion. Impulsive laughter is an infrequent symptom. Sometimes severe boring, sticking pains and paresthesias are complained of, but they never have quite the character of lancinating pains. Ataxia is very frequently present, and may be either cerebellar or spinal in character. The disease pursues an irregular course. It progresses for a time as if it were going to incapacitate the victim. Then there is a cessation of symptoms and he gets all but well and remains so for several months, perhaps even a year; then the activity of the disease reveals itself again and the patient soon becomes more helpless than he was before. In the majority of instances transient diplopia and subjective vertiginous states are the earliest symptoms. In every instance in which spasticity occurs in a young individual and no apparent cause can be found for it, multiple sclerosis should be thought of.

Treatment.—The treatment of multiple sclerosis presents many difficulties, and, as we know of no specific drug to arrest the development of the small patches, we are obliged to fall back on general hygienic measures, regulation of diet, etc. These patients should be warned against overexertion, mental strain, worry, and the like. The physician should so regulate their daily life that it is on an even plane. Long, exhausting work or exercise should be avoided; the bladder and rectum emptied regularly and at stated intervals. Rest in bed after a severe remission will often improve them greatly. Hot baths are to be avoided (Oppenheim), but tonic baths, salt rubs, and passive resistance exercises should be employed. These have the good effect of general supportive measures, improve the circulation in the spastic limbs, and help prevent contractures.

Among the drugs, silver nitrate (gr. ¼ to ¾, t. i. d.) and Credé's ointment have been extensively used. The latter is especially recommended by Oppenheim. Mercury has been employed, but should be used with great care, because of the tendency to optic nerve atrophy. Strychnin should not be used in most cases, because it tends to increase the spasticity. We have seen very good results follow the daily hypodermic administration of cacodylate of soda, ¾ to 1 gr. It appears to hasten remissions and unquestionably prolongs them. Veronal has been recommended for the tremor, but its constant use is a dangerous practice. As yet electricity has proved of little avail. Mild central galvanism may be lightly applied to the neck and spine. Opotherapy offers little hope as yet, and the same may be said of sera inoculations and vaccines.

The severe contractures are best treated by mechanical apparatus, or, if these are not successful, tenotomies and even section of the posterior roots may be necessary.

CHAPTER IX

DISEASES OF THE PERIPHERAL NERVES

HOWELL T. PERSHING

TREATMENT OF NEURITIS IN GENERAL

The word "neuritis," meaning inflammation of a nerve, is here used to denote the morbid processes excited in nerve fibers by any injurious influence, whether physical, infectious, or toxic. Thus used it includes mechanical damage, sometimes amounting to complete section, and also processes which are degenerative rather than inflammatory, as in the neuritis of diphtheria or lead poisoning. If a sensory nerve is affected the characteristic symptoms in its distribution are pain, more or less sensory loss and trophic changes in the skin. If a motor nerve, there is paralysis or weakness of the muscles supplied by it with muscular atrophy, loss of tendon reflexes and faradic irritability, and changes in the galvanic reactions. If a mixed nerve is affected all of these symptoms are present in some degree. Of recent years it has unfortunately become very common to apply the term "neuritis" to any painful affection, especially of the shoulder and arm, although all the characteristic symptoms, except pain, are absent. Such cases are generally rheumatic infections and it is a gross error to confuse them with genuine neuritis. There are certain lines of treatment applicable to all cases of injury or inflammation of the peripheral nerves, and in order to avoid needless repetition these will be considered first. The special modifications or additions needed for individual nerves will be given later.

Removal of Cause.—The first and most important indication for treatment is to remove the cause of the disease. In mononeuritis, or localized neuritis, which involves a single nerve or a few adjacent nerve trunks, local causes such as injury or localized infection predominate. In multiple neuritis, or polyneuritis, which involves many nerves in different parts of the body, only a correspondingly widespread cause can be sufficient, namely, a general infection or intoxication. Both general and local causes may act in combination.

In traumatic cases the involvement of a nerve will be indicated, in addition to the location of the wound, by a small area of sensory loss and paralysis of the muscles in its distribution. The surgical treatment of such cases requires a very delicate, exacting and elaborate technic, acquired only by special training and experience (Stookey). The physician should be responsible only for the examinations necessary to reveal the state of the nerve and the advice as to the indications for operation. In the primary cleaning of the wound the injured nerve should be exposed. If it is not severed it should be let alone in as favorable a position as possible. If it is severed and the operating field not already infected the ends should be freshened by an exactly transverse cut and properly sutured together, without axial rotation. If infection has already occurred it is useless to attempt repair of the nerve; the wound should be allowed to heal and some months later, when infection has disappeared, a secondary nerve suture can be undertaken. This should be done as early as conditions permit but even when delayed one or two years success is still possible. If the gap between the ends of the severed nerve is too great, even in the most favorable posture, to permit suture, a transplant, preferably from one of the patient's less important nerves, may be used to bridge the gap (Huber, Stookey). As the nerve sacrificed is usually smaller, several sections of it may be used to form a cable transplant whose cross section equals that of the nerve repaired (Elsberg). In rare cases, on account of the proximal part of the divided nerve being inaccessible, its distal part may be united to the proximal part of a less important adjacent nerve.

The part of the nerve sutured should be enveloped in fascia, Cargile membrane or sections of artery previously prepared in order to protect it from scar tissue and prevent adhesions (Huber). After suture such a posture as will prevent tension of the nerve must be maintained for from two to three weeks, after which passive motion may be cautiously begun and the limb gradually extended. The limb must also be kept in such a posture that the paralyzed muscles will be relaxed. Regeneration of the nerve fibers will not restore the function of muscles as long as they are stretched by the unrestrained action of their opponents. Special forms of splint are used to meet this indication in injury of the different nerves (Buerki). Passive motion must be employed daily to prevent fixation of joints and tendons. Pressure must of course be carefully avoided.

If the injury is caused by fracture of a bone its ends are to be brought into correct apposition and sutured, then the nerve is to be separated as far as possible from the fracture by the interposition of fascia or muscle. This must be done immediately, as the nerve degenerates very rapidly under continued pressure.

In case the nerve is injured, but not severed, it should be given time in which to regenerate. The regenerating neuraxes, if not obstructed at the seat of lesion, should make their way toward the periphery at the rate of about 1 cm. per week. If, after the lapse of ample time, which will vary from six months to a year according to the nerve and position of the lesion, no signs of returning function appear, then neurolysis should be done. The nerve should be exposed and freed from scar tissue or adhesions, at the same time placing it in such a position and so enveloping it with fascia as to prevent future adhesions.

Pressure, stretching, or irritation of nerves due to adjacent disease or new growth must as far as possible be removed by treatment of the primary disease. If infection has extended from a suppurating wound to a nerve, free drainage of pus is the first essential, after which every effort should be made to increase the systemic resistance to infection by means of fresh air, food, cheering mental influences, tonics, and an appropriate vaccine.

Constitutional causes are of the greatest importance in multiple neuritis, but they may also be of fundamental importance in neuritis limited to a single nerve. Syphilis, tuberculosis, and gout are especially apt to cause a localized rather than a multiple neuritis. Other important conditions, most often causing multiple neuritis, are alcoholism, diabetes, severe anemia, and poisoning by lead, arsenic, mercury, ptomains, etc. The so-called rheumatic or uric acid diathesis is often an important aggravating cause even when the neuritis is mainly due to other agencies. If this condition, as now seems probable, is really due to recurrent infection, the most important indication is to find and remove the source of infection, which may be in the tonsils, teeth, ear, accessory sinuses or any part of the body where pus is formed and not freely drained. In addition, this condition calls for the administration of sodium salicylate, aspirin, salophen, or some other form of salicylate. In any of these constitutional states, aside from the treatment of the specific infection or intoxication, which is described in its appropriate place in this work, free elimination is to be secured by means of laxatives, diuretics, and diaphoretics, having due regard, of course, to the patient's powers of resistance. In all forms of neuritis there is a marked tendency to nervous and constitutional debility which must be combated by a diet as nutritious, abundant, and varied as the digestive organs can be made to tolerate. If any restriction is necessary let it be in the carbohydrates. Proteins and fats are most essential.

Rest.—Next in importance to the removal of cause is rest of the affected area from every mode of activity, whether motor, reflex, or sensory. The more severe and more recent the disease or injury the more nearly absolute is the indication for rest. Enough passive motion to prevent fixation should be used from the beginning, but not until pain

has mostly subsided can any form of local stimulation or voluntary activity be safely ventured upon.

An affected limb should be wrapped in a generous quantity of cotton secured by a bandage just tight enough to stay in place. The limb should be in the posture of greatest ease, with relaxation of the paralyzed muscles. The arm is to be moderately abducted at the shoulder, the elbow slightly flexed, the forearm between pronation and supination, the wrist slightly extended, and the fingers moderately flexed. The lower limb is to be slightly flexed at the hip and knee with a little outward rotation and abduction, the foot being at right angles to the leg. In multiple neuritis the proper posture is to be maintained by the support of soft pillows of suitable size so that both muscles and nerves will be relaxed and free from pressure, with no occasion for voluntary effort. Wrist drop or foot drop may be prevented from the first by a proper arrangement of the supports. For the feet Gowers recommends a large sandbag 9 inches in diameter, placed transversely in the bed so that the ball of the foot and toes will rest upon it in such a way as to secure the perpendicular position. Or a board may be secured across the bed for the feet to rest upon. The weight of the bed coverings must not rest upon the limb. If the supports mentioned do not sufficiently protect it a wire frame must be used. In localized neuritis special splints may be needed to maintain the most favorable posture.

It is best to maintain an equable warmth of the affected part. Changes of temperature prevent sensory rest, hence they are to be avoided as carefully as mechanical irritation. In the most acute cases a warm, moist dressing or poultice gives more relief than the dry cotton. Especial care must then be taken to see that the temperature is below what can be borne with comfort by the sound skin, on account of the extreme vulnerability of tissues supplied by an inflamed nerve and the consequent danger of severe trophic disturbances. Warmth with some moisture may be secured by using cotton as recommended above, but covering it with rubber tissue. Some writers recommend cold applications in severe local inflammation, but it must be remembered that the tissues are excessively vulnerable to cold as well as to heat and pressure. In general, warmth is to be preferred.

In recent cases, especially if severe, massage and electricity are strictly contra-indicated, but are often urged upon the physician by the patient or his overzealous friends. Even the electric tests that are desirable for diagnosis to some extent aggravate the disease, as indicated by increase of pain, so they should at first be as brief and infrequent as the diagnostic requirements will permit. I have known patients with alcoholic multiple neuritis to have their sufferings greatly increased and the prospects of recovery lessened by daily applications of a strong faradic current, the physician as well as the patient being under the

delusion that the increased pain following each application ought to be endured because electricity may be useful in the treatment of paralysis.

Relief of Pain.—The removal of causes and the maintenance of rest in the easiest posture tend strongly to relieve pain, but, in spite of all that can be done in this way a good deal of neuritic pain will usually remain, and it is of such a peculiarly trying, nerve-racking character as to prevent refreshing sleep and seriously to impair the general health. Additional measures for the relief of pain alone are generally necessary, but Gowers wisely warns against using these measures to permit harmful activity, which, without analgesics, would be too painful. In other words, analgesics and narcotics should be sparingly though efficiently used for the relief of the spontaneous pain which persists after the most perfect rest and protection have reduced it to a minimum.

Gowers strongly recommends the hypodermic injection of cocain at the seat of greatest pain, not only as an efficient though temporary means of relieving suffering, but also as having a distinctly favorable effect upon the morbid process by cutting off irritating sensory impulses from the periphery. Oppenheim also mentions it as a palliative, especially in the form of Schleich's infiltration anesthesia. From 1/10 to 1 per cent of cocain in normal salt solution is employed and injected near the nerve in the area of greatest pain. At first not more than gm. 0.005 or 1/12 of a grain of cocain should be used. When the patient's tolerance is known as much as gm. 0.065 or 1 gr. may be injected twice daily. The weaker the solution the larger the area that can be covered without exceeding the dose. Gowers also speaks of cocain satisfying the craving for a stimulant, but this also carries with it the warning that a craving is easily created by the use of the drug and that the cocain habit is especially demoralizing. These objections to cocain may to a great extent be obviated by substituting its less poisonous substitute, procain (novocain), in the same or larger doses.

As an internal analgesic, unless contra-indicated by the state of the heart or of the blood, one of the coal-tar preparations should be tried. Acetphenetidin (phenacetin) is probably the best, and may be given in single doses of from gm. 0.3 to 1.0 (5 to 15 gr.), maximum in one day gm. 2.0 (30 gr.). Instead of acetphenetidin one of the similar drugs may be used in its appropriate dose: kryofin in the same doses as acetphenetidin; antipyrin, gm. 0.65 to 2.0 (10 to 30 gr.), maximum in one day, gm. 4.0 (60 gr.); salpyrin in the same doses as antipyrin; acetanilid, gm. 0.2 to 1.0 (3 to 15 gr.), maximum in one day, gm. 1.50 (23 gr.), pyramidon in the same doses as acetanilid.

If the coal-tar preparations are contra-indicated or ineffectual an opiate will be necessary. Codein is nearly harmless and may be given in a single dose of from gm. 0.03 to 0.15 (½ to 2 1/3 gr.). Purified opium has more power to relieve pain and also to secure sleep, dose gm. 0.03

to 0.13 (½ to 2 gr.), or extract of opium, gm. 0.015 to 0.07 (¼ to 1 gr.); or morphia, gm. 0.01 to 0.03 (⅙ to ½ gr.). If one of these is not sufficient hypodermic injections of morphia will be necessary, especially at night. All authorities are agreed that this should be only as the last resort. Unless the patient's tolerance is already known the first dose must always be small, then the amount can be cautiously increased to meet the necessities of the individual case.

Sleep.—It is of great importance that a patient suffering from neuritis should have sound and refreshing sleep. The opiates made necessary by pain may be sufficient to secure this, but it is often desirable to add one of the hypnotics.

I regard chloral as on the whole the best hypnotic. It will generally secure sleep of the necessary duration, and of a refreshing quality, with less disadvantages than any other single drug. Its dose is from gm. 0.5 to 1.5 (7½ to 23 gr.); maximum in one night, gm. 2.0 (30 gr.). Bromid may be used instead in a single dose of gm. 1.0 to 2.0 (15 to 30 gr.), but is not so efficient, and larger doses, if continued, seem to me more likely to depress nutrition and lower resistance to infection than equally efficient doses of chloral. Veronal is very efficient in inducing sound sleep. The principal objection to it is that it often leaves the patient unrefreshed, heavy, and rather despondent next day. When it acts in this way its prolonged use is highly objectionable. Some patients, however, bear it very well, and with them it is the hypnotic to be chosen. Whatever is necessary should be given in a single dose of from gm. 0.3 to 1.0 (5 to 15 gr.), as its maximum effect is some hours after its administration. Sodium veronal and the solution of veronal known as neuronidia have the advantage of acting with the minimum dose in the shortest time. Luminal, gm. 0.1 to 0.3 (1.5 to 4.5 gr.) at bedtime, is as efficient as veronal and seems to be free from its objectionable effects.

Counterirritation.—In multiple neuritis counterirritation is not advisable, but in mononeuritis due to a sharply localized injury or infection it may be of use. Light stroking with the Paquelin cautery over the nerve a little above the seat of inflammation is most effective, but small blisters may be used instead. Such applications are not to be made in the distribution of the nerve below the seat of disease for fear of starting an ulceration which may persist as a trophic lesion. It is in the later stages of the disease that counterirritation is most useful, but in milder cases it may be used at the outset. In the early stages of severe cases it is better to omit it.

Massage.—As spontaneous pain subsides and that induced by passive motion of the affected part is of short duration and less intense, massage, with systematic passive motion, may safely be begun. This may be in a few days in the lightest cases, and in from four to eight weeks in the severe ones. In the meantime all that is necessary in the line of mechano-

therapy is the support of the foot and hand that will prevent foot drop and wrist drop, together with just enough passive motion to prevent fixation.

The object of massage is to accelerate the flow of lymph and venous blood from the diseased tissues so that fresh lymph and blood may take their place. This is to be accomplished with the least possible irritation and the nerve trunk must be avoided. At first the manipulations should be exceedingly gentle, consisting only of a light rubbing or stroking of the skin in the direction of the venous current. As tenderness subsides the stroking may be somewhat more vigorous and enough pressure may be used to influence the deeper tissues. Severe or persistent pain following massage should always cause it to be made lighter or for the time to be omitted altogether. With the massage gentle passive motion of all the joints should be made, carefully avoiding all brusque changes and extreme positions. At the same time the posture should be varied from that of greatest ease so that the patient will become accustomed to lie with both the hip and knee extended.

Electricity.—All authorities are agreed as to the value of electricity in the treatment of neuritis; and electrical treatment should be begun soon after the first use of massage and passive motion. It is also generally agreed that the galvanic current is superior to all the other forms of electricity. The faradic current is valuable for diagnostic tests, but in this disease its power to cause contraction of the affected muscles is lost or impaired, while its effect on the inflamed nerve is that of a powerful irritant. In chronic or convalescent cases a neurologist who is also an expert electrotherapist may do good with it, but even then more can be accomplished through galvanism. I think that it should be a general rule not to use faradism in the treatment of neuritis. The sinusoidal current, when available, can be used to excellent advantage.

The galvanic current is used in two ways for two distinct purposes. As originally recommended by R. Remak and endorsed by E. Remak, Bernhardt, and Oppenheim, the cathode is applied over the seat of the nerve lesion and the anode to any convenient place. The current is turned on gradually by means of a smoothly working rheostat, kept steadily at a strength of from 2 to 6 ma. for from five to ten minutes, and then gradually turned off. All abrupt changes must be avoided. The weaker and briefer applications are best at the beginning and in all cases in which the nerve is excessively sensitive; as the effect of the applications is ascertained and sensitiveness is found to be decreasing, the current may be used for a longer time and its strength cautiously increased. If severe or persistent pain is caused the current must be decreased or the treatment postponed. Gowers employs a similar method, but he uses the anode over the inflamed part and suspects that its value is only that of a counterirritant. According to the German neurologists the effect of

these applications is to improve circulation in and about the inflamed nerve, to promote the absorption of the products of inflammation, and to improve the conductivity of the nerve fibers by direct stimulation. E. Remak gives careful observations tending to prove that these things are really accomplished and the course of the disease materially shortened. The results obtained by others generally confirm his claims; certainly the galvanic treatment of the nerve itself in old cases of moderate severity is often followed by a striking improvement after only a few applications.

The other method is to apply the cathode or anode, whichever causes the greater contraction, to the paralyzed muscles without regard to the nerve, and by slowly making and breaking the current directly to stimulate the muscle to contract. Its object is to exercise the muscles and keep them in the best possible state of nutrition, delaying their degeneration until they come under the influence of the restored motor fibers and end plates. This direct stimulation to contraction is just what the faradic current cannot accomplish, because it acts on the muscles only through the nerve fibers, which are destroyed or put out of action by the disease. Although this galvanic treatment of the muscles is not necessary in the lightest cases, and is of little avail in the most severe ones, where the restoration of the nerve fibers is long delayed and the muscles lose even their galvanic reactions, nevertheless there is a great preponderance of cases in which this treatment is certainly useful. It should be tried in practically every case. The applications may be from three times weekly to daily. Each muscle is to be relaxed by posture so that it is free to contract without resistance. The strength of the current will vary from 2 or 3 to 10 ma., according to the muscle treated and the size of the active electrode. It should be just sufficient to cause a moderately vigorous contraction. Very strong currents are to be avoided as they lead to exhaustion. The sinusoidal current is efficient for the same purpose.

Baths.—In the middle and later stages of the disease warm baths may be used to favor relaxation, peripheral circulation, and absorption.

Exercise.—As soon as some voluntary control of the paralyzed muscles is regained active exercises should be added to the passive motions already mentioned. The weakened muscles should at first be favored by posture and by the assistance of the operator, so that the patient's efforts may produce the greatest visible result. Care is to be taken to stop short of severe fatigue.

Late Operations.—If, after more than a year from the onset, there is still considerable disability, with but little hope of further improvement, careful consideration should be given to the possibility of a late performance of neurolysis or nerve anastomosis leading to better results. Orthopedic operations such as section of tendons or transplantation of muscles may possibly be indicated, but not so frequently as in poliomyelitis. Orthopedic appliances may also be useful without operation.

Drugs.—Aside from the treatment of causes such as syphilis, malaria, or metallic poisoning, drugs can have but little effect upon the morbid process. Gowers, indeed, speaks highly of mercury as an alterative in localized neuritis, 1 gr. of blue pill once or twice a day. He does not consider it so useful in multiple neuritis. Salicylate of sodium given as in acute rheumatism is useful in cases due to cold or having a rheumatic or gouty element. But if drugs can do little to cure the neuritis itself, they are valuable for the relief of many symptoms. The relief of pain and insomnia has already been discussed. Throughout the course free elimination must be maintained, especially by the judicious use of laxatives. Tonics, especially strychnia and iron, will be needed in all protracted cases.

Change of Scene.—A patient with any form of neuritis is especially apt to become demoralized and everything possible should be done to keep up his courage and interest. As in other long illnesses convalescence may often be hastened by a change of air and scene, especially if agreeable recreation accompanies the change. In winter the patient should go to one of the warm, balmy localities, in summer to the seashore or mountains, but never to regions that are both cold and damp.

NEURITIS OF SPINAL NERVES

Phrenic Neuritis

(*Paralysis of the Diaphragm*)

Only very rarely is disease of the phrenic nerves causing paralysis of the diaphragm amenable to special treatment. When the nerve is involved in wounds, inflammation, or tumor of the neck the treatment, if possible, of the primary disease is the essential object. When inflammation of the phrenics is a part of multiple neuritis their treatment is for the most part included in that of the greater disease. The danger is great on account of the dyspnea and tendency toward complete failure of respiration. Extreme care should be taken to secure the most perfect rest possible. Talking as well as other forms of exertion is to be prevented. In order that the abdominal contents shall not encroach upon the thorax the head and chest should be elevated. If dyspnea persists in spite of complete rest and correct posture, inhalations of oxygen may be used. Counterirritation along the sides of the neck has been recommended and no doubt is useful in cases of active inflammation. Strychnia and an abundance of food are indicated.

In addition to these measures Duchenne recommended faradization of the nerve, and this has been warmly approved by Bernhardt, and briefly

by Oppenheim. A small button-shaped electrode is applied at the posterior border of the sternomastoid muscle, at the junction of its middle and lower thirds, and pressed downward and inward between this muscle and the scalenus anticus, while the other electrode is applied over the abdomen. When the nerve is healthy the diaphragm can easily be made to contract in this way. Gowers thinks that the influence of this procedure is not sufficient to make its use desirable, and he seems clearly to be right as far as disease of the nerve trunk is concerned. If the nerve fibers are diseased neither the faradic nor the galvanic current applied in this way can have much effect. In the cases of asphyxia from gas poisoning, of apparent death in the newborn and of paralysis of the diaphragm in epidemic encephalitis it is not the nerve fibers, but the nerve centers, that are probably at fault, and artificial respiration seems to me to be far more promising than faradization.

As to prophylaxis, care should be taken by anesthetists, surgeons, and obstetricians not to turn the head too forcibly to one side and not to keep it long in an extreme position. Oppenheim has seen paralysis of one phrenic nerve caused by such forcible turning.

Neuritis of the Brachial Plexus and Nerves of the Arm

In neurological treatises the diseases of the parts of the brachial plexus and of the nerves arising from it are discussed in separate chapters. This separation, however, is on account of varying symptomatology and for the sake of localization diagnosis, not on account of difference in treatment. For the discussion of treatment alone and especially to avoid tedious repetition it seems better to consider them together.

The brachial plexus and the nerves derived from it are not only liable to the same toxic and infectious diseases as other nerves, but are especially liable to disease and injury incident to their situation. The use of the arm exposes it to many special dangers. Blows, cuts, punctures, and pressures on the unprotected soft parts of the arm or neck often involve the nerves, as a rule directly, sometimes by subsequent extension of disease. Fractures and dislocations often cause pressure or laceration of the plexus or the nerve trunks, especially the musculospiral. Moreover the great mobility of the bones of the shoulder and arm permits a number of extreme postures, without either fracture or dislocation, which are capable of causing great injury to the nerves, amounting in some cases to a complete separation of nerve roots from the spinal cord. These facts make it necessary to give special attention to prevention.

Prevention.—A great many cases of brachial neuritis could be prevented if the possibility of their occurrence were generally known. A statement of some of the special causes is sufficient indication for their prevention.

A workman carries a heavy weight on the shoulder so that its edge presses into the side of the neck; pressure neuritis of the posterior thoracic nerve and paralysis of the serratus magnus muscle follow, or perhaps neuritis of the upper cord of the plexus and paralysis of the upper arm type of Erb. The shoulder is forcibly drawn back as in pinioning the arms; the upper cord of the plexus is squeezed between the clavicle and first rib so that paralysis of the upper arm type follows. A crutch is used so that the weight of the body, instead of being supported mainly by the hands, is borne by the axilla; neuritis of the musculospiral results with paralysis of the extensors of wrist and fingers. Severe strain on the uplifted or extended arm, as in hanging from a ladder or reining an unruly horse, stretches the upper part of the plexus, especially if the head is inclined away from the arm. Other easily avoidable causes are allowing the arm of an anesthetized person to hang over the edge of the table, holding the arms above the head for a considerable time, going to sleep with the arm hanging over the back of a chair, lying with the head resting on the upraised arm or merely the prolonged maintenance of an awkward position and excessive work with the arm raised above the head, as in whitewashing a ceiling. Tight bandaging, or the prolonged action of a bandage that is even a little too tight, may cause severe neuritis. In giving hypodermic injections a nerve cannot be injured unless the deep fascia is pierced: this can be avoided by pinching up a fold of the skin.

According to Goldthwait, Painter, and Osgood, neuritis of the ulnar nerve may be caused by the common deformity, round shoulder. As the shoulder joint, from fatigue and relaxation of the muscles which normally hold it backward and upward, sags downward and forward, the head of the humerus may compress the ulnar nerve against the second rib, causing a true pressure neuritis. In thin persons the ulnar nerve alone is usually affected, but in stouter patients a padding of fat may transmit the pressure to the whole plexus. The pain thus caused is aggravated by postures and occupations which increase the forward drag on the shoulder and relieved by postures which elevate the head of the humerus and keep it away from the thorax. Some cases of writers' cramp are to be explained in this way. The treatment consists of exercises and a brace to hold the body erect and the shoulders well back. If the scapula is flexed so that the correct posture is painful and the patient is an adult, removal of its upper portion may be necessary.

Obstetric Paralysis.—The prevention of injury to the plexus or nerves at birth which causes the paralysis, usually of the upper arm type, known as obstetric paralysis, is a special problem for the obstetrician, but the same principles apply. Delivery is to be accomplished, avoiding as far as possible any extreme position of head or arm and any excessive traction on either, especially traction on the arm when the head is inclined

away from it. Prolonged pressure is to be feared, if on the neck, shoulder, axilla, or arm.

Treatment.—In traumatic cases prompt aseptic dressing of wounds and immediate treatment of a fracture or dislocation are essential. The question whether any nerve trunk is completely divided comes up at once and is answered mainly by the presence or absence of sensation in the small area exclusively supplied by the nerve in question. The ability voluntarily to contract the muscles supplied by the nerve, of course, shows that the nerve is not divided, but the inability to make such voluntary motions is not proof of division of the nerve because it may be due to injury of bone, muscles, or tendon. If division has occurred and the field is aseptic immediate suture is vastly better than secondary suture, but no limit can be set beyond which operation is hopeless. If the gap is too great to be closed in any way the peripheral part of the severed nerve may be sutured to the proximal part of a neighboring sound one, as the musculospiral to the median. If a fragment of bone or callus is pressing on the nerve it must be removed. Callus may first cause paralysis years after the original injury (Oppenheim). After an injury or operation in the neighborhood of the plexus or a nerve trunk, for example, the removal of glands from the axilla, neuritis may occur as a remote consequence from late changes in the wound. If the nerve is embedded in inflammatory products or drawn by scar tissue it should be exposed by dissection beginning either below or above the lesion, freed from adhesions, and protected from future ones, by placing it in a more favorable situation between the muscles or wrapping it in a flap or fascia or other suitable membrane. The ulnar nerve is sometimes dislocated from its position back of the inner condyle of the humerus. On account of its liability to injury in its new location it should be replaced and retained by covering with a flap of periosteum (Chipault). From the beginning the limb should be placed at rest by means of such a splint as will secure relaxation of all the paralyzed muscles thus preventing their elongation and the shortening of their antagonists. A special splint will as a rule have to be made for each case (Buerki, Stookey).

After acute symptoms have sufficiently subsided the rest which is at first imperative should gradually be broken by passive movements, massage, and galvanic electricity, as described under the Treatment of Neuritis. The galvanic current should be applied smoothly and steadily with the active negative electrode over the lesion and the anode on the muscles, and also slowly interrupted with the active electrode on the muscles, whichever one gives the greater contraction.

In the obstetric paralysis of infants correct posture should be maintained and passive motion, *very gentle* massage and galvanic treatment persisted in for many months. If at the end of a year there is no prospect of further recovery under this treatment the injured part of

the plexus or nerve should be exposed, freed from surrounding scar tissue and, if necessary and possible, resected and sutured. For details see the articles of Clark, Taylor, and Prout and the textbook of Stookey.

If, after all attempts to restore nerve function, an important muscle remains paralyzed, the condition may perhaps be improved by splitting off a portion of a sound neighboring muscle and attaching it to the insertion of the paralyzed one. Thus a part of the sound pectoralis major has been stitched to the paralyzed serratus magnus or deltoid; part of the deltoid or biceps to the triceps; the sound flexor carpi ulnaris to the paralyzed extensors of the wrist and fingers, etc. These are highly specialized operations whose scope and value are still under discussion and vary greatly in the opinions of those best qualified to judge. They should not be undertaken except by those who have special knowledge and skill in this particular field.

Neuritis of the Lumbar Plexus and Nerves of the Leg

External Cutaneous Neuritis (Meralgia Paresthetica).—This affection, limited to the external cutaneous nerve and causing a painful numbness of the skin of the outer side of the thigh, is rare but of considerable importance in some cases, so that it has been made the subject of a number of special articles. Its commonest causes are infections (especially typhoid fever, syphilis, and articular rheumatism), injury, exposure to cold, alcoholism, obesity, and diabetes.

Bernhardt, who first described it, says that a very important part of the treatment is the assurance of the alarmed patient that the disease is limited, not progressive and not serious. Treatment should be directed to the cause, as prevention of pressure by the sword worn by officers, abstinence in alcoholism, mercury in syphilis, salicylates and removal of all sources of infection in rheumatism, diet in diabetes. Analgesics, counterirritation and electricity may be used as in other forms of neuritis. While often obstinate, the disease is not as a rule serious enough to demand operation. The nerve, however, can very easily be resected, or, better still, injected with alcohol where it passes beneath Poupart's ligament, close to the anterior superior iliac spine. Neisser and Pollack regard the disease as caused by pressure on the nerve by the margin of the fascia lata and have advised slitting the fascia.

Anterior Crural and Obturator Neuritis.—Localized neuritis of these nerves is rare, but the possible causes are numerous. The most important of these are new growths (starting from the spine, retroperitoneal glands, pelvis, or femur), psoas abscess, appendicitis, aneurysm of the femoral artery, cold, gout, alcoholism, diabetes, injury to the pelvis or femur, and prolonged flexion of the hip during a surgical operation. After removing causes as far as may be possible the general treatment

for neuritis should be employed. If further restoration is not to be expected a flexor tendon, that of the biceps for example, might be attached to that of the quadriceps extensor, as has been done after poliomyelitis (Oppenheim).

Sciatic Neuritis (Sciatica).—The term "sciatica" is commonly understood to mean pain of a neuralgic character in the course and distribution of the sciatic nerve, without the symptoms that would indicate neuritis or other organic disease. Gowers thinks that the great majority of cases described as sciatica are really cases of neuritis, as shown by the character of the pain, more or less sensory loss, absence of Achilles' jerk, and wasting of the muscles. Oppenheim, on the other hand, holds that the indications of neuritis are generally very slight and that most cases are of a neuralgic rather than of a neuritic character. Accordingly he describes sciatica as a neuralgia separately from sciatic neuritis. He says, however, that it is impossible always to distinguish the two, and that every possible gradation exists between a manifest neuritis and a pure neuralgia. As the treatment is for the most part the same, and as I regard sciatica as neuritic rather than neuralgic, all forms are considered here, with no attempt to differentiate them except as to their causes.

Fully developed sciatica is a very formidable disease. The disability and severe suffering caused by it and the obstinate resistance of many cases to a great variety of modes of treatment have made it, like trigeminal neuralgia, a reproach to our profession. The main reason for this lack of success in the difficult cases is not that these cases, like those of tabes, are essentially incurable. It is because the causes of the disease are so many and often so obscure that in a given case it is very difficult for the physician to determine what is the fundamental indication for treatment. Removal of any active cause is essential, yet this is often left to nature while efforts are concentrated on the obvious necessity of relieving pain. As an unknown cause sometimes disappears spontaneously, but often does not, merely palliative treatment may be brilliantly successful in one case and a total failure in another. Hence the great number of remedies recommended and the consequent confusion and uncertainty. This is further increased by reporting as sciatica, cured by this or that treatment, cases of pain, referred to the region of the sciatic nerve, which is neither neuralgic nor neuritic, but neurotic, that is, hysterical. These may be converted into cases of grave organic disease by mistaken treatment. Oppenheim mentions a case of irremediable peroneal paralysis caused by exposing the nerve and applying strong carbolic acid to it to cure a sciatica which was hysterical. Under the rules of a hospital requiring consultation before major operations a neurological colleague and myself were once called upon to approve an amputation of the thigh for which an hour had been set. The patient's complaints of pain had led to a section of the peroneal nerve. This giving no relief a piece of the nerve

2 inches long was removed at the level of the head of the fibula. The complaints continuing, amputation was proposed and accepted by the patient. We found no evidence of any organic disease or any form of sciatica, but regarded the pain as clearly hysterical. The amputation was not done, but the complete wasting and paralysis of the anterior tibial and peroneal groups of muscles of course remained.

Assuming the purely neurotic imitation of sciatica to be excluded we have to remember that the fibers of the nerve in their long course from the spinal cord, at the level of the first lumbar vertebra, through the spinal canal, pelvis, thigh, and leg are exposed to many possibilities of damage through localized injury or disease. A thorough examination from both the neurological and surgical standpoint is necessary in order to detect or exclude disease in each of the various parts of its course. For the purpose of treatment our best classification is one based on causation, first local, then general.

Radicular Sciatica.—The roots of the sciatic nerve are long, reaching from the level of the first lumbar vertebra to the fifth lumbar and first three sacral intervertebral foramina. They are liable to damage by meningitis, especially that caused by syphilis, fractures of the vertebræ, inflammation of the vertebræ, especially Pott's disease, new growth of the bones or meninges, and arthritis deformans encroaching on the intervertebral foramina. In radicular sciatica the pain is commonly bilateral, and may also be felt in the distribution of the anterior crural or other lumbar nerves. The tender points of Valleix and the sign of Lasègue (aggravation of the characteristic pain of sciatica by extending the leg when the thigh is at right angles to the trunk) are absent. The pain is increased by coughing. Sometimes areas of hyperesthesia corresponding to those supplied by definite roots may be made out.

The treatment of this form of sciatica is not often successful because the original cause is generally beyond cure. If there is a suspicion of syphilis, mercury should of course be tried, and followed by iodids. Pott's disease may yield to proper mechanical support and constitutional treatment. For the relief of pain the epidural injections of Cathelin should be tried, and are much more likely to succeed than injections applied to the trunk of the nerve in the buttock or thigh. After sterilization of the skin with alcohol, ether and tincture of iodin, and placing the patient in the knee-chest position, or on the side affected with the thighs flexed, the needle, such as is used for lumbar puncture, or an ordinary one 2½ inches long, is inserted in the median line of the spine, between the sacral tubercles and 7 to 7.5 cm. (2 4/5 to 3 inches) from the tip of the coccyx. It should enter perpendicularly until the sacrococcygeal ligament is pierced, which can be recognized by the feeling of piercing a membrane, when it is pointed upward at an acute angle, so as to enter the sacral canal without penetrating the dura. The depth of insertion is 4 to 5 cm. (1 3/5 to 2

inches). Two c.c. of a 1 per cent solution of cocain or 2 to 8 c.c. of a ½ per cent solution of procain in Ringer's solution properly sterilized are to be slowly injected. A characteristic sensation is generally felt, formication in the limbs and a "feeling of distention spreading upward from the buttocks, or of water flowing in the loins." The pain is promptly relieved and relief may last two or three days, perhaps becoming permanent (Lannois and Porot). Lévy and Baudouin recommend larger injections, gm. 0.01 or 0.02 (⅙ to 1/3 gr.) of cocain, or twice as much stovain, in 20 c.c. of normal salt solution, but they say that epidural injections in radicular sciatica are inconstant in their effect, which is to be expected in sciatica. I have secured temporary relief but no permanent result. If these injections fail Lévy and Baudouin recommend subarachnoid injections, as in spinal anesthesia for operations, but with smaller doses of cocain or stovain, not exceeding gm. 0.03 to 0.04 (½ to 3/5 gr.). The relief is generally only temporary, and this method is not recommended for ordinary sciatica.

Sacro-iliac Sciatica.—One of the most important recent advances in the knowledge of sciatica is the discovery that many cases are caused by dislocation, sprain, relaxation or inflammation of the sacro-iliac joint, and that these cases can be cured only by measures which will give the joint rest and support. The lumbosacral cord, whose continuation forms the peroneal nerve, and the first sacral nerve are immediately in front of the joint, while the second and third sacral nerves are separated from it only by the origin of the pyriform muscle. Swelling of the joint or displacement of the upper portion of the sacrum either forward or backward stretches these nerves. I have seen the most intense and characteristic sciatic pain instantly caused for the first time by a sprain of this joint, brought about by a misstep in the dark. Aside from peculiarities in standing and walking, which might be attributed to sciatica from any cause, disease of the sacro-iliac joint causing sciatica may be recognized by the following tests, abstracted from the book of Goldthwait, Painter, and Osgood, to which the reader is referred for a full explanation: (1) Standing with the knees extended while bending the trunk forward as though to pick up an object causes pain in the affected joint and lumbar region, with reflex spasm of the lumbar muscles restricting the motion. This is because the pull of the hamstring muscles on the ischium prevents the pelvis from tilting forward, so the sacrum must move on the ilia, causing a strain of the sacro-iliac joints. If the patient now sits with the knees flexed and bends forward the pain and restriction of motion are much less, because the hamstring muscles being relaxed the ilia are free to tilt forward with the sacrum, putting but little strain on the sacro-iliac joints. Were the disease in the lumbar spine, as the location of the pain and spasm might lead one to suspect, forward flexion would be equally painful and difficult whether standing or sitting. (2) If the patient lies on the

back and the thigh on the affected side is flexed on the trunk, and then the leg extended, as in the familiar test for sciatica, pain is felt not only along the nerve, but in the sacro-iliac joint and lumbar spine. This test is the converse of the preceding, the hamstring muscles moving the ilium on the sacrum. If the same manipulation is done on the sound side pain is felt on the affected side, but it is less severe because the pull of the hamstring muscles first moves the ilium of the sound side on the sacrum, which is then moved on the ilium of the affected side. If in making this test the thigh is flexed on the trunk with the knee also flexed but little pain is felt, except in extreme positions or in exceedingly acute cases. This is because the hamstring muscles are relaxed and do not pull on the ischium. In hip joint disease flexion or extension of the knee would make no difference. (3) If the joint is inflamed swelling and tenderness may perhaps be recognized by palpation from without or by rectal examination. (4) Increased mobility of the joint may be recognized by palpating the sacro-iliac joints with one hand and the symphysis pubis with the other, while the patient flexes either thigh with the knee extended. This will cause the characteristic pain and reflex restriction of motion as in Tests 1 and 2.

If this joint is dislocated, the dislocation must, of course, be reduced and a dressing applied to maintain the bones in place. If strained and inflamed the first requisite is rest, which in all severe cases should begin with rest in bed. The joint should be fixed by a plaster jacket, taking in the thorax, the hyperextended lumbar spine, the pelvis, and, if necessary, by a spica extension, the thigh or even both thighs. After acute symptoms have subsided, and in milder cases from the first, support of the joints may be all that is necessary without confining the patient. This support may be a plaster jacket or a belt firmly girding the pelvis between the iliac crests and the trochanters, and held down by perineal straps or attachment to the corset. At night a small pillow under the lumbar spine and one under the knees is of special importance. In mild cases, for temporary relief, overlapping strips of adhesive plaster, carried from the anterior part of the ilium on one side to the corresponding part on the other, may be sufficient. For important details the reader is referred to the work of Goldthwait, Painter, and Osgood, to Pitfield, and to Young.

The orthopedic indications having been fulfilled, this form of sciatica has a strong tendency to get well without other treatment. Pain may for a time require relief, and a diathetic condition may call for treatment. If the joint is thought to be in a rheumatic condition careful search for a removal of the source of infection is the most important indication; meanwhile a salicylate should be given. Injections into the nerve trunk are not indicated in this form of the disease.

Sciatica from Intrapelvic Disease.—Within the pelvis the sacral plexus may be injured by various processes; an infection may extend to the

nerves from any of the pelvic organs, an exudate or a new growth may encroach upon them, and harmful pressure may be exerted by the fetal head, by the enlarged or displaced uterus, by a fecal accumulation, or even by venous congestion. The pelvic examination must be thorough, and, if any of the conditions mentioned is found to have a causal relation to sciatica, its successful medical or surgical treatment is essential. In cases where suppuration within the pelvis has affected the nerves, in addition to the ordinary methods of drainage, an appropriate vaccine may be useful.

Sciatica from Damage to the Nerve Trunk.—In its course through the thigh and leg the sciatic nerve may be exposed to many causes of mechanical damage or local infection, such as the pressure of a hard seat; injuries, inflammations, or operations about the hip or knee; fractures, especially of the upper part of the fibula; violent muscular action or working in a kneeling posure. The detection of any of these causes will carry with it the indications for the treatment necessary to relieve the nerve of pressure, irritation, or continued infection. If the nerve trunk is believed to be enveloped in exudate or bound by adhesions, it should be freed by dissection. This is decidedly preferable to the so-called "bloodless stretching." The nerve will always tend toward recovery, however slowly, as soon as the original cause is removed.

Sciatica from Constitutional States.—If no cause of local damage to the nerve roots, plexus, or nerve trunk can be discovered, a constitutional cause will probably be found. The sciatic nerve, especially its peroneal part, like the musculospiral, is excessively vulnerable in the presence of a general infection or intoxication. There is no specific infectious disease which may not exert a selective influence upon the peroneal nerve so as to cause neuritis with the accompanying pain, paralysis, and atrophy. Any streptococcus infection, puerperal fever, typhoid, influenza, even gonorrhea, may be such a cause. Of the intoxications, alcoholism, gout, diabetes, and poisoning by arsenic and lead must be considered. Exposure to cold is a very important predisposing cause. These are also the causes of multiple neuritis, but they may act, with or without slight local injury, so as to cause sciatic neuritis alone; or sciatica may persist after the other nerves involved in multiple neuritis have recovered. In any case of sciatica, therefore, even though a local cause may be apparent, these possible constitutional factors must be looked for, and, if found, efficiently treated. Gout or rheumatism will be found more frequently than any other one constitutional cause, and salicylates with saline laxatives will be found more useful than any other drugs.[1]

Symptomatic Treatment.—In any case of sciatica, while causes are being removed as far as possible, and, indeed, after they have been re-

[1] Chronic intestinal auto-intoxication should always be looked for, especially in the recurring form.—Editor.

moved, special treatment of symptoms will be necessary, for if once damaged the nerve recovers but slowly.

The first essential, as in other cases of neuritis, is rest. In all severe cases the patient must be in bed, the limb supported by pillows so that the thigh is slightly flexed and rotated outward and the knee slightly flexed. The foot is to be kept at right angles to the leg, by a pillow or, if necessary, by a large sandbag or a board placed across the bed, and must be protected from the weight of the bedclothes. Support under the lumbar spine to maintain its normal curvature is advisable.

Cold applications are generally to be avoided, because disagreeable and likely to depress the tissues. Warmth, on the other hand, is soothing and useful. Hot fomentations may be applied by Siegrist's method, described by Oppenheim as follows: "A towel folded lengthways, so that it forms a compress 10 cm. (4 inches) broad, is immersed in hot water of 40° to 50° R. (122° to 144° F.), wrung out, and laid along the affected nerve; over this is placed a broad strip of flannel which covers the towel, and above this again several layers of paper"; all held in place by a broad roller bandage. "The fomentation is renewed after ten to fifteen minutes, and this process is kept up for one to two hours several times a day." Lévy and Baudouin recommend full warm baths lasting an hour. Cupping, wet or dry, and the application of leeches have been found useful.

Counterirritation may be used in the form of friction with irritating liniments, mustard leaves, repeated small blisters along the course of the nerve, or, most efficient of all, light stroking with the Paquelin cautery over the seat of the greatest tenderness. The faradic brush and static spark have been recommended as counterirritants, but have no advantage to make up for their inconvenience unless it be a mental impression.

The galvanic current may be useful; large electrodes should be employed, and the current in proportion to the area of the active one, ¼ to ½ ma., for each square centimeter, or 1½ to 3 ma., for each square inch. The active cathode should be over the seat of greatest tenderness, and the anode over the lower course of the nerve. The current must be turned on and off gradually. In most cases of sciatica the muscles are not affected so severely as to need treatment to keep up their nutrition, but, if they are paralyzed, they should be stimulated to contract by means of the galvanic current, as described in the treatment of neuritis in general. What has there been said in regard to massage also applies here.

Injections into the Nerve Trunk.—For prompt relief of pain and also for ultimate cure, in properly selected cases, a method of treatment by injection into the nerve sheath has been developed which gives far better results than any of the earlier modes of treatment. It is especially valuable, as it is most successful in the cases in which the causes are obscure and rational treatment has accordingly been most difficult.

Cases Benefited by Injections.—The cases most likely to be cured or greatly benefited by injections are the subacute and chronic ones, not due to disease of the spine, sacro-iliac joint or pelvis, in which pain persists after all known causes have, as far as possible, been removed. If the cause is either spinal or pelvic the epidural injections of Cathelin, already described, are more efficient, because they act on the nerve roots above the seat of irritation. Injections into the nerve trunk are not so strongly indicated in the acute cases, in which other measures would naturally be given a trial first. Nevertheless, they have been successfully used in a considerable number of acute cases. Hysterical patients with pseudo-sciatica should not receive this treatment; it may happen to make the right mental impression, but this can better be secured in simpler ways.

Solution for Injection.—Cocain, eucain, stovain, novocain, or any other of the local anesthetics, if injected in the usual quantities of a hypodermic injection into the nerve or very close to it, *above the seat of irritation,* will give complete relief for a short time, usually not more than a few hours. If injected into the nerve trunk when the irritation is in the pelvis or spinal canal, some relief will be obtained, because the diseased part is shielded from the additional irritation of impulses from the periphery, but the relief will naturally be incomplete as well as temporary. The great success of the alcohol injections introduced by Schlösser in 1904 for trigeminal neuralgia naturally led to their trial in sciatica. Here, too, they at first promised to be highly successful. Nevertheless, alcohol for this purpose has been entirely abandoned, because it is capable of destroying the conductivity of nerve fibers, and, as the sciatic is a mixed nerve, with most important motor and trophic functions, there is too great a risk of causing a complete paralysis and wasting of the muscles supplied by it. It was at first thought that alcohol would not cause such a paralysis, and in the early cases of Schlösser and his followers it did give relief from pain without paralysis, but later cases and many experiments on animals show that, if the alcohol is strong enough to relieve the pain and is really injected into the nerve trunk, it will almost inevitably cause an atrophic paralysis, which may be many months in disappearing, if it disappears at all. The use of alcohol or any other destructive agent, such as chloroform, osmic acid, or carbolic acid, is not justifiable, as there are solutions which are both safe and efficient.

It is now generally agreed that the salt solution introduced by Lange is harmless, or nearly so, and that it or some modification of it should be chosen. A large quantity should be used, 40 to 100 c.c. (1 1/3 to 3 1/3 fluid ounces), or even more; 60 c.c. (2 fluid ounces) is an average amount. Many variations of the solution have been used, some preferring strongly hypertonic, others isotonic salt solutions, but only the isotonic solution should be used. In one case a strong solution caused permanent paralysis. Some add novocain or stovain, while others think this

unnecessary. Solutions of the salts of magnesium and other salts of sodium give results as good as, but no better than, salt solutions. The following will serve every purpose: procain (novocain), gm. 0.1 (1½ gr.), in tablets combined with adrenalin, normal salt solution, 60 c.c. (2 fluid ounces); sterilize the salt solution by boiling for half an hour, and then add the tablets and boil again for a moment before using.

Place to Inject.— If the pain is mainly in the peroneal distribution below the knee, injection into the peroneal branch, where it turns around the head of the fibula, may be sufficient; or, if a previous injection at the higher point has left some peroneal pain, a supplementary injection here is desirable. It is very easily done, unless the patient is too stout for the nerve to be felt. The fact that the needle has struck the nerve will always be indicated by a characteristic shooting pain. The best place to reach the main trunk of the nerve is where it passes over the spine of the ischium, immediately after leaving the pelvis through the great sacrosciatic foramen. This has the advantage of being the highest accessible point on the trunk, hence the injection is more likely to be above the seat of irritation. As the nerve here passes between a bony point and the pyriform muscle, it is itself one of the points likely to be irritated. It can be accurately located by means of anatomical landmarks, and the bone beneath the nerve gives definite information when the needle has penetrated far enough. To find the point on the surface which is perpendicularly over the spine of the ischium, measure from the middle of the sacro-

Fig. 1.—Dried Pelvis with the Course of the Sciatic Nerve Indicated in Black. The crosses mark the sacrococcygeal junction and the upper end of the postero-external border of the great trochanter. The nerve is to be injected where it crosses the spine of the ischium just below its exit from the great sacrosciatic foramen.

coccygeal junction to the upper end of the postero-external border of the great trochanter. Mark the junction of the inner and middle thirds of this line and then go 1 inch further out. This is the point where the needle is to be inserted, and it should be marked so that it can be found after sterilizing the skin. It also lies on a line joining the posterior-superior spine of the ilium, and the tuberosity of the ischium at the junction of its middle and inferior thirds, but this is not so good a guide because the tuberosity is hard to define. The landmarks given have been worked out by Richet and by Lévy and Baudouin, and have been tested, clinically and on numerous cadavers, by Hecht.

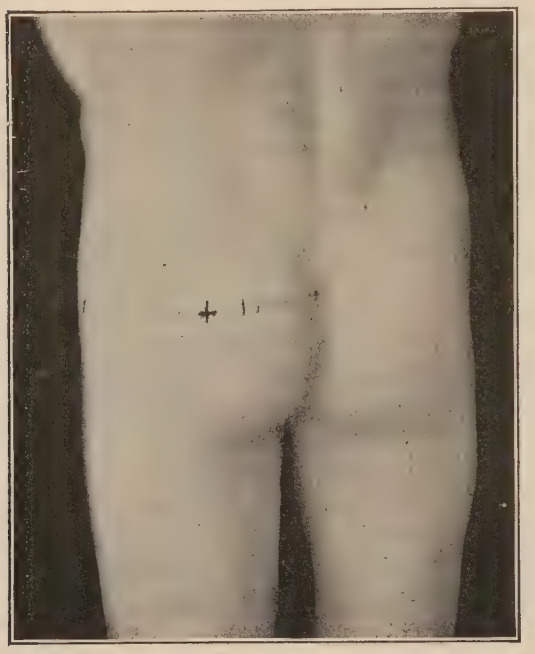

Fig. 2.—The Cross Marks the Point on the Buttock Which Is Perpendicularly Over the Sciatic Nerve Where It Crosses the Spine of the Ischium. This point is on a line joining the sacrococcygeal junction and the upper end of the postero-external border of the great trochanter, one inch external to the junction of the inner third of this line with its outer two thirds.

Technic. — The buttock should be sterilized with alcohol and ether, and it is well to paint the point of insertion with iodin. This point and the tissue immediately beneath should be anesthetized with a little solution in a hypodermic syringe with a fine needle. This refinement is not strictly necessary, but patients with sciatica have already had all the suffering that is good for them, and even the most hardened will appreciate being spared whatever is unnecessary.

The needle must be a strong one, so as not to be broken by muscular contraction; 1.5 mm. (1/16 inch) in diameter, and at least 10 cm. (4 inches) long. It is an advantage to have it marked in centimeters. It should be beveled but not very sharp, and furnished with a stylet. The syringe should hold 60 c.c., and be readily attachable to the needle. Both must be sterilized by boiling in soda solution or in some other efficient way. Most operators recommend the lateral position, with knee and thigh semiflexed, or the knee-chest position, but I prefer with Hecht to have the patient lie on the abdomen with thighs and knees extended. This makes it easier to control disturbing motions.

The needle with syringe attached is inserted slowly perpendicular to the surface. As its point advances beyond the area already anesthetized a few drops of the solution are injected. When the nerve is reached at a depth varying between 4 and 10 cm. (1 3/5 and 4 inches) the patient always experiences a characteristic shooting pain in the heel or along the course of the nerve, usually with jerking of the muscles. It is essential to elicit this "control pain" in the peroneal or posterior tibial distribution according to the seat of the greatest spontaneous pain. The sciatic at this point is really two nerves in one sheath, the fibers coming from the lumbar cord and going to the peroneal nerve lying on the outer side, while those coming from the sacral roots and going to the posterior tibial nerve are on the inner side. The solution is now slowly and steadily injected and the needle withdrawn. The puncture is sealed with collodion and cotton. The patient is to remain in bed until the second day following.

Results.—In a large proportion of cases there is immediate relief of sciatic pain. If the injection is large, slight fever is apt to follow, and does not mean an accidental infection. A moderate degree of local pain and tenderness is to be expected. It can be treated by warm fomentations. If very severe, as it sometimes is, it must be controlled with morphia. In approximately two-thirds of the cases treated by this method cures have been obtained. Sometimes a single injection has been sufficient, but in the more obstinate cases two to five have been required. The method is as safe as any direct action on a large nerve can be, but there is some risk involved in it. A very few injections have been followed by peroneal paralysis, not nearly as many as one might expect, and such cases will probably recover completely, as the solution, properly prepared and sterilized, has no harmful chemical effect. If the site of injection should become infected it would be a very serious complication. With due care this is exceedingly improbable, but it is possible even with a perfect technic if the patient has a focus of suppuration elsewhere in the body, the originally sterile site of injection becoming the place of least resistance to a metastatic infection.

For further details the reader is referred to the article of Hecht, already cited, and to Lévy and Baudouin.

Surgical Operations.—In the past a small proportion of the obstinate cases of sciatica have been treated by exposing the nerve in the thigh and stretching it with considerable force so as to free it from adhesions and cause an appreciable elongation. The results varied greatly. Some cases were improved and ultimately cured, others were made worse. The general result was not nearly so good as is now obtained from injections; consequently, this operation should no longer be done. Stretching the nerve without incision, but by extending the knee and then forcibly flexing the thigh on the trunk to a right angle or beyond, the so-called bloodless

stretching, was also occasionally successful, but often made matters worse. It has properly fallen into disuse.

Pain not otherwise relieved will require analgesics or narcotics, as discussed in detail under the Treatment of Neuritis in General. In the incurable cases and those with the severest pain morphia hypodermically is indispensable, especially at night, but should, of course, be kept at a minimum and dispensed with as soon as possible.

REFERENCES

Since Chapters IX, X, and XI are so closely related, the references for all three chapters have been combined in a single list at the end of Chapter XI, page 366.

CHAPTER X

DISEASES OF THE CRANIAL NERVES, MULTIPLE NEURITIS, LANDRY'S PARALYSIS, POLYMYOSITIS

HOWELL T. PERSHING

DISEASES OF THE OPTIC NERVE

OPTIC NEURITIS

In optic neuritis rest of the inflamed nerve is the first indication. This cannot be complete, for confinement in a dark room would be too depressing, but all use of the eyes should be given up and bright light avoided. Wind, dust, and smoke are harmful. The mind, as far as possible, should be cheerfully occupied. Aside from rest the treatment is almost exclusively that of its underlying cause.

From Organic Intracranial Disease.—Intense optic neuritis, known as choked disk, is marked by great swelling of the papilla, so that it projects forward into the vitreous and spreads out laterally, and by engorgement and tortuosity of the veins, perhaps with hemorrhages. Such a neuritis is generally caused by intracranial tumor. If the tumor is possibly syphilitic vigorous treatment with mercury, by inunctions or intramuscular injection, and iodid of potassium, should be begun immediately. Arsphenamin is at first contra-indicated, but may be used later with great advantage. If this treatment fails, or it is certain that the growth is not syphilitic, surgical intervention is the only means that will prevent death or blindness in the near future. The growth should, of course, be removed, if possible, but if, on account of its size, situation, or nature, this is impracticable, a prompt operation for decompression alone may be advisable, in order to save vision and to prolong, although not ultimately to save, life. Other organic intracranial diseases causing optic neuritis, usually not so intense as that of tumor, are: abscess, meningitis, disseminated sclerosis, and epidemic encephalitis. Their treatment is described elsewhere in this work.

In Toxic Conditions.—Many toxic conditions must be considered as possible causes demanding treatment. The most important of these are:

syphilis, alcoholism, uremia, lead poisoning, arsenical poisoning, tobacco poisoning, pernicious anemia, leukocythemia, and obscure conditions following acute infectious diseases. In the cases of metallic poisoning potassium iodid facilitates elimination, but, unless given in very small doses, cautiously increased, it may aggravate the condition.

From Suppuration of the Middle Ear or Nasal Sinuses.—It is not sufficiently known that suppuration of the middle ear may cause double optic neuritis, more marked on the side of the ear disease, without any apparent intracranial lesion. The connection is not understood, but it is probable that there is a continuous line of infection. In such cases the erroneous diagnosis of abscess may be made and a useless operation done; or the cause may not be suspected and nothing be done. A radical operation on the ear and its adjacent bony cavities to remove all infected tissue is essential. If successfully done the effect on the optic nerves may be surprisingly good.

In an extreme case of this kind in which neuritis and hemorrhages had at one time reduced vision to light perception, and in which the most exhaustive study failed to show the probability of any cause except suppuration of the ear, I saw improvement begin immediately after operation on the ear, and go rapidly to restoration of excellent vision for reading and writing. In such a case I would now use an autogenous vaccine, but would not delay operation (Pershing).

Rarely infection of one of the accessory nasal sinuses, especially the sphenoid, is the cause of optic neuritis. In such a case opening and draining the sinus may be followed by prompt and permanent recovery.

From Myelitis.—The cause of the optic neuritis seen in occasional cases of inflammation of the upper part of the spinal cord is not definitely known, but we may infer that it is a metastatic infection either from the focus in the spinal cord or from its primary source elsewhere in the body. Unfortunately, the myelitis is scarcely amenable to treatment of any kind, and tends rapidly toward a fatal issue, but an effort should be made to find and remove the primary focus.

Cases without Apparent Cause.—There are some cases in which the most careful and repeated examinations fail to indicate any cause. In these cases the immediate danger of blindness, the fear of fatal intracranial disease which cannot yet be recognized, and the inability to promise any substantial benefit from treatment make the physician feel his limitations. Treatment, nevertheless, must be prompt and vigorous. After securing the necessary rest and tranquillity already mentioned, free elimination through the skin, kidneys, and bowels is to be secured. This can best be done by means of aspirin, hot packs, wet or dry, and saline laxatives. Tonics, especially strychnia, and perhaps iron, are indicated. Finally, even in cases that are not syphilitic, mercury by inunction or injection and potassium iodid ought to be given to promote rapid absorption of the

exudate in the nerve. As long as no irremediable cause appears, the case is not hopeless, and the search for a source of infection should be continued.

I have seen perfect recovery in two cases of this kind. In one the neuritis was like that of intracranial tumor (choked disk), and vision was reduced to light perception, first in one eye and then in the other. In neither case did anything in the history before or after recovery give any clew to a possible cause.

Optic Atrophy

Atrophy of the optic nerves is either secondary to optic neuritis (including retrobulbar neuritis and neuroretinitis) or it is primary. The treatment of the secondary form must naturally be that of the preceding neuritis, for all cases of neuritis tend toward atrophy. Secondary atrophy may appear to be primary, although the ophthalmoscopic appearances are usually distinctive, because the preceding neuritis may have passed unobserved or may be retrobulbar. Moreover, the intracranial causes of neuritis may in rare cases cause atrophy without preceding inflammation. In any case of atrophy, therefore, all the possible causes of neuritis, intracranial, toxic, and infectious, should be systematically considered with a view to treatment. As in cases of neuritis, the possibility of syphilis being the cause should always be borne in mind, and, even if the case is not syphilitic, mercury and potassium iodid are indicated as long as there is any inflammatory exudate to be absorbed.

Primary atrophy is often part of a disease that is itself incurable, as tabes, paretic dementia, Friedreich's ataxia, spinal muscular atrophy, or disseminated sclerosis. In almost all of these cases, even though considerable vision remains when treatment is begun, the destruction of the remaining fibers goes on. Nevertheless, there are enough exceptions to make treatment worth while, and, in disseminated sclerosis, while the disease is incurable, any particular part of it may undergo arrest or even notable improvement. In cases of tabes with optic atrophy antisyphilitic treatment must be cautious. As in optic neuritis, arsphenamin is contra-indicated until mercury and iodid have been used. The possibility of lead or arsenic being the cause of atrophy, primary or secondary, must not be forgotten, and the search for the lead line on the gums, the arsenical pigment spots on the skin, and either metal in the urine must be thorough, as well as the study of the history and occupation.

After any possible cause has been treated as effectually as may be possible, the atrophic process may to a certain extent be combated by strychnia. Oculists commonly give strychnia once daily hypodermatically in the temple, gradually increasing the dose up to gm. 0.015 or 0.020 (¼ to 1/3 of a grain). I think it wise to follow this practice, but would ex-

pect the same results from injections into any other part of the body or from administration by the mouth.

The galvanic current can be applied by putting a pad of moist cotton over the closed lids and applying the cathode to this while the anode is on the back of the neck. The current is to be turned on and off gradually, and to be allowed to flow steadily at a strength of from 3 to 6 ma. I have never seen this do any good, but Schmidt-Rimpler, with his great experience, is sure that it does. Of late years the high frequency current has been highly recommended. I have had no experience with it.

NEURITIS OF THE THIRD, FOURTH, AND SIXTH NERVES

Paralysis in the domain of these nerves is a common and very important symptom in intracranial tumor, meningitis, thrombosis of the cavernous sinus, tabes, bulbar paralysis, spinal muscular atrophy, myasthenia gravis, and disseminated sclerosis. In any of these diseases other symptoms will probably be so combined with the ocular paralysis as to lead to the more general diagnosis and the appropriate treatment. Fracture of the skull with consequent pressure from hemorrhage may be a cause and the nerve may completely recover when the blood is absorbed. Various infections may cause paralysis of these nerves, the most important being syphilis, which is relatively common and usually yields to treatment, unless too long delayed. Of the acute infections, diphtheria, influenza, scarlatina, measles, and typhoid fever occasionally cause ocular paralysis either through a meningitis, which is almost invariably fatal, or by a more localized action, whose prognosis is far more favorable. Paralysis in the distribution of one or more of these nerves is a very common early symptom of epidemic encephalitis.

Forms of intoxication which may cause ocular paralysis are alcoholism, diabetes, uremia, ptomain poisoning, and occasionally plumbism.[1] These nerves are especially sensitive to such drugs as the belladonna and cocain groups and aconite. Transient paralysis in this field has followed spinal anesthesia by cocain and stovain. It has also appeared as an untoward result, usually transient, of the deep injection of alcohol into the middle branch of the trigeminus for neuralgia. It is one of the risks of operation at the base of the skull, especially that for extirpation of the gasserian ganglion. Finally, from the absence of other probable causes and a history of exposure, some cases must be attributed to cold and regarded as analogous to the ordinary form of facial paralysis; in fact, both forms, ocular and facial paralysis, sometimes appear together on the same side after exposure to cold.

[1] In recent years there have been several outbreaks of botulism which also causes ocular paralysis.—Editor.

Aside from the indications suggested, all acute cases and the infective and toxic ones should be treated by rest in bed, sweating, diuresis, and such purgation as is well borne. Counterirritation by small blisters on the temple and local bloodletting by natural or artificial leeches are valuable in the more inflammatory and congestive cases.

Electricity cannot readily be applied to the muscles of the eyeball, and Oppenheim warns against trying to reach them with fine electrodes. The galvanic current may, however, be applied by placing a pad of warm moist cotton over the closed lids, the cathode on this, and the anode on the back of the neck. From 2 to 5 ma. may be used, or just enough current to cause contraction when the cathode is applied to the facial muscles and the current closed. The current should flow steadily when applied to the eye, as the shock of making and breaking it would be too irritating. When the acute symptoms have subsided strychnia in full doses is advisable as a nerve tonic.

The annoying diplopia may be obviated with advantage for a time by the use of a light bandage or opaque glass over the affected eye. The use of the eye, especially such as calls for action of the weakened muscles, must only gradually be resumed, taking care to avoid excessive fatigue. Binocular vision may sometimes be restored by prescribing prisms, but they cannot satisfactorily correct any high degree of insufficiency. Operation on the muscles may be advisable, but only after other means of restoring balance have been exhausted, and there is reason to believe that the degree of defect is fairly constant and not too great. This is a special question for the oculist in each case.

Periodic Ocular Paralysis.—Cases of this rare affection probably have different causes. Some are clearly associated with migraine, constituting the *migraine ophthalmoplégique* of French writers. These should be treated like other cases of this neurosis, with extraordinary care to avoid ocular fatigue. They have a comparatively good prognosis, but not so good as cases of ordinary migraine. In other cases, even though some of them seem clearly to be migrainous at first, the periodic attacks are early symptoms of organic intracranial disease, either vascular or degenerative, and the paralysis may become permanent. Hence, the prognosis must be guarded and the treatment must be according to the causal indications furnished by the history and physical examination.

TRIGEMINAL NEURITIS

Neuralgia, which is by far the most frequent disease affecting the trigeminal nerve, is not regarded as an organic disease, and is treated under the neuralgias. Herpes zoster is also separately considered.

Almost all other diseases of this nerve are secondary to tumor, inflam-

mation, aneurysm, or injury at the base of the skull, and these must be treated according to their nature and seat. Among them syphilis is especially frequent, and in doubtful cases thorough antisyphilitic treatment should be given. The intense pain caused by organic disease affecting this nerve must be treated by analgesics, and, these failing, by injections, as in cases of neuralgia. Even when the irritation is central to the injection shielding the diseased area from impulses starting in the periphery may do considerable good.

Primary neuritis is exceedingly rare; when it occurs it is generally in association with neuritis of the seventh nerve or a part of multiple neuritis. The treatment is that already indicated for pain in addition to the treatment of the principal disease. Paralysis of the muscles of mastication is to be treated with the galvanic current, as in other cases of neuritic paralysis.

NEURITIS OF THE SEVENTH NERVE

(*Facial Paralysis—Bell's Palsy*)

The great majority of cases of facial paralysis are of the so-called rheumatic type, that is, they are due to exposure of the face to cold or a prolonged draft of air, or the cause is not ascertained. Nevertheless, the numerous other possible causes of the rarer cases are first to be considered. In all of these treatment appropriate to the original cause is to be carried out, as far as may be possible, to be followed later by the local treatment advised for the rheumatic type.

Intracranial Disease.—Intracranial new growths, inflammations, and injuries to the base of the skull may affect this nerve before its entrance into the internal auditory canal. In such cases other nerves are almost necessarily involved, especially the eighth, and the general signs of intracranial disease will be present. Among the causes of such disease syphilis is of the greatest importance.

From Disease of the Temporal Bone.—The long curved course of the nerve through a narrow bony canal, from the internal auditory meatus to the stylomastoid foramen, exposes it to attack from any affection of the bone, and at the same time makes any swelling in this part of its course an immediate cause of damage by pressure. Fracture, caries, tuberculosis, or gumma of the bone, with hemorrhage, inflammation, or pressure in the canal, may easily cause paralysis, which usually comes on so rapidly as to appear sudden.

Suppurative disease of the ear is the most important cause of disease of the temporal bone. The mere coincidence of facial paralysis with disease of the ear does not, however, without further investigation, war-

rant the assumption that the paralysis is caused by the disease of the ear. The two conditions may possibly be entirely independent, or they may both be dependent on a common cause, such as exposure or injury. Operations on the diseased ear not very rarely cause facial paralysis, because of the very close relation of the nerve to the aural cavities and especially to the antrotympanic passage.

When suppurative otitis causes facial paralysis it is almost always chronic and has caused necrosis of the bone. Early treatment by a skilled otologist would prevent this stage being reached, but when the nerve is involved the prospect of its restoration is not good. In any case, however, the most thorough treatment of the ear and its adjacent bony cavities is urgently demanded, irrespective of the effect on the nerve, but with the hope that it will recover if intracranial infection be prevented and life be saved. Pus must be evacuated, all necrotic and granulomatous tissue removed, and drainage maintained. According to the condition of the ear and temporal bone, any operation may be necessary, from paracentesis to the radical cleansing of the mastoid, antrum, and tympanum. It may be advisable to remove enough of the facial canal to free the nerve from pressure and infected surroundings, although this involves a fresh danger. In traumatic cases, including those caused by operation, primary suture should be done if possible. Certain specific diseases, including influenza, typhoid fever, diphtheria, mumps, erysipelas, and tonsillitis, occasionally cause facial paralysis, no doubt by an extension of the adjacent local infection to the nerve near its exit from the stylomastoid foramen. Removal of any remaining source of infection is the paramount indication.

Rheumatic and Idiopathic Cases.—These should always be regarded as possibly infectious and thorough search should be made for a primary focus with a view to its prompt removal. The rheumatic cases if seen early should have leeches applied below the ear or a blister over the mastoid process, in the hope of reducing the assumed congestion and swelling in the facial canal. Revulsion by a hot mustard foot bath, followed by sweating, diuresis, and purgation, is appropriate. Aspirin, being a salicylate, probably antagonizes streptococcus infections and is an efficient diaphoretic.

If there is pain limited to the external auditory meatus and inner surface of the auricle, it is explained by Ramsay Hunt's theory that the facial is not a purely motor, but a mixed, nerve having sensory fibers whose distribution is in the meatus and auricle, whose root ganglion is the ganglion geniculatum, and whose sensory root is the nerve of Wrisberg or portio intermedia. If pain extends beyond this area it means that some branches of the trigeminus are also involved. In either case the pain is best treated by warm poultices behind and in front of the ear or by the dry heat of a water bag.

Cold applications should always be avoided, and in the course of treat-

ment special care is to be taken to avoid chilling the face. One of Oppenheim's cases of facial paralysis was caused by the application of ice to the neck as a remedy for tonsillitis, and it is a familiar fact that, long after a nearly perfect recovery, exposure of the face to cold causes renewed stiffness and weakness. The inability to close the eye is often a source of much annoyance and also of some danger, as the tears are not properly distributed and the exposed cornea is injured by drying, in addition to the irritation of the whole eye by light and dust. The patient should be instructed to close the eye frequently by gently pressing the lids together with his fingers and thumb, thus sheltering and moistening the eyeball from time to time. At night the lids may be held closed by a wad of moist cotton, held in place by a light bandage. This may be used during the day.

The sound side of the face should frequently be drawn over toward the median line and the muscles of the paralyzed side drawn away from it. In the more severe cases adhesive strapping should be used to prevent the paralyzed muscles from sagging. Yawger describes his device for this purpose as follows:

"My method is, first, to cut a strip of plaster 1½ inches wide and about 1¾ inches long, which is firmly pressed well up on the temporal region; this attaches itself securely to the scalp and hair and will remain for a considerable time. Next, a similar strip is cut about 2 inches in length, one end of which is folded on the adhesive side for about ¼ inch as reënforcement and in this two perforations are made. Then a strip is cut about 3 inches in length reënforced as before and correspondingly perforated; the other end is divided longitudinally about 2¼ inches. Finally two cords are inserted vertically into the perforations and the device is completed. Apply the support by firmly pressing the smaller strip over the permanent one already adherent to the temporal region, adjust the divided one to the sagging cheek, approximate the free ends and tie the cords securely."

From the beginning light, skillful massage may also be of benefit, but the physician should be sure that it is really light and not overdone. If electrical treatment is properly carried out, professional massage is rarely necessary.

Electricity for treatment is contra-indicated during the first week or ten days, and its use then for diagnosis is not so valuable as later. There is no objection, however, to faradic or galvanic tests at any time.

After ten days the facial muscles should be carefully tested with both the faradic and galvanic currents for the purpose of prognosis. Complete loss of faradic irritability and greater anodal closure contraction than cathodal closure contraction, both being sluggish (this combination of reactions constituting the reaction of degeneration), mean that the case is severe and that no marked improvement will be manifest until after three months. On the other hand, if cathodal closure contraction is

greater than anodal closure contraction and both are quick, but faradic irritability is lost, the case is only moderately severe and earlier improvement may be expected. If faradic irritability is retained the case is one

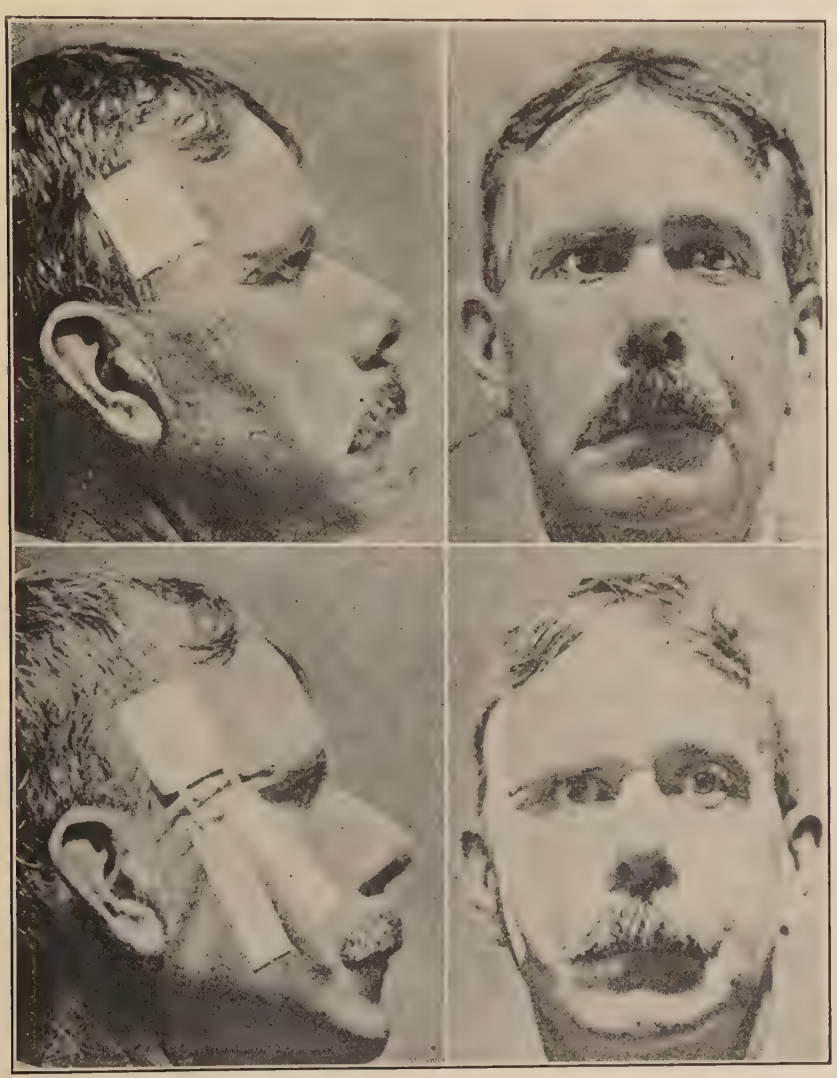

Fig. 1.—Yawger's Device for Support in Facial Paralysis. (From *Archives Neurology and Psychiatry*, Dec., 1920.)

of the lightest and may recover in from two to four weeks. Most of these light cases would, no doubt, recover without treatment, but they do better with it. Both the severe and the light cases should receive galvanic but not faradic treatment.

To act on the lesion itself a small electrode or the well-padded curved

edge of a larger one should be gently applied between the jaw and the mastoid process; this should be the cathode and the anode may be over the cheek. The current is turned on gradually, allowed to flow at a strength of from 3 to 6 ma. for three to five minutes, and gradually turned off.

To maintain and improve the condition of the paralyzed muscles the indifferent electrode is applied to the back of the neck, and the active one, usually somewhat smaller, is applied to the orbicularis oris; then the current is gradually increased and slowly interrupted until closing it produces a moderate contraction. This will occur first with the cathode on the muscle in mild cases, but with the anode in severe ones. Whichever arrangement of poles produces the greater contraction with the same current is to be chosen. The active electrode is now applied to the different muscles in turn, the current being closed a few times to secure contractions of each muscle. It is better to leave a muscle and come back to it than to fatigue it by causing too many contractions in close succession. The strength of current will vary from 1 to 6 ma., according to the area covered by the active electrode and the muscle acted upon. The essential thing is to get moderate contractions without pain or fright. About the eye and on the forehead the susceptibility to pain is greater and weaker currents must be used. Special care must be taken in treating the orbicularis palpebrarum not to irritate the eyeball. The upper lid is drawn down gently over the eye before the electrode is applied. In the later stages, in addition to slow interruptions of the current, the muscles about the mouth and cheek, and those near the eye, with a weaker current, may be stroked with the active electrode, so as to give a kind of electric massage which is very stimulating. The whole treatment should last from ten to fifteen minutes and be repeated from three times weekly to daily, according to the circumstances.

The general health of the patient, both physical and mental, is to be guarded and built up by all available means. Of medicines, aside from those that fulfill a causal indication, like mercury, or are called for by incidental disorders, strychnia is the most important on account of its general tonic properties and its special effect on motor neurons. Food, moderate exercise, and fresh air are important, but the face must be carefully guarded from cold and wind even after convalescence is well advanced. Although paralysis of the face, even of the cortical type, is practically never seen as a part of hysteria, there is no doubt that emotional conditions can in some way affect peripheral facial palsy. Oppenheim saw it twice in the same patient, each time apparently caused by fright. We should not neglect, therefore, to foster courage and tranquillity.

Many severe cases make only a partial recovery. Some power of voluntary contraction comes back, but along with it comes a tonic contracture of the muscles, so that the nasolabial and other furrows become deeper

than on the sound side, which, being smoother, may now be mistaken for the paralyzed one. On voluntary or emotional action, however, the mistake is quickly corrected as the appearance is reversed, the contractions on the sound side being of much greater amplitude. There is no remedy for this state. When it appears electrical applications should be discontinued, for they can do little or no good; but, on the other hand, they should not be regarded as having helped to cause the contracture. Balls have been carried in the mouth to distend the cheek and massage with stretching movements has been tried. There is no objection to such stretching, but it accomplishes so little as to be hardly worth while.

Late Operation.—In traumatic cases where no considerable degree of recovery has taken place during a year's treatment surgical intervention may still give hope of improvement or even recovery. If the central part of the nerve is sound, freeing its trunk from the pressure of exudate or scar tissue (neurolysis) may permit recovery to begin. Or the damaged part of the trunk may be excised and the ends brought together and sutured; this, however, is rarely possible. Union of the peripheral part of the facial with the central part of the hypoglossal or spinal accessory has been successfully accomplished. Return of the muscular tone, so that the appearance of the face in repose has been improved, and some degree of voluntary motion of the paralyzed side, have been restored by the successful operations of this kind. The voluntary motions, however, are crude, the patient having to think of moving the shoulder or tongue, as the case may be, and are marred by undesirable associated movements of these parts. In emotional expression the defect is as glaring as ever (Lannois and Porot). I have seen one remarkably successful case of this kind, in which W. W. Grant of Denver sutured the peripheral part of the facial to the central part of the spinal accessory, and at the same time, to remedy the paralysis of the trapezius and sternomastoid muscles caused by section of the spinal accessory, cut the descendens hypoglossi and sutured its central part to the peripheral part of the spinal accessory. There was very little inconvenience from weakness of the trapezius at any time. Fifteen weeks after operation slight movement of the facial muscles appeared in association with efforts to raise the shoulder. The restoration of the facial muscles in repose was eventually nearly complete and strong voluntary contractions were possible. The annoying association of movements became less marked and the shoulder movements were normal or nearly so. The disparity of the two sides of the face in emotional expression remained. The operation most recommended is end to end suture of the peripheral part of the facial to the central part of the hypoglossus and of the peripheral part of the hypoglossus to the central part of the descendens hypoglossi, thus completely sacrificing only the comparatively unimportant muscles supplied by the descendens hypoglossi (Stookey).

Congenital Facial Paralysis.—Congenital cases, if due to defective development, are not amenable to treatment of any kind. If caused at birth by pressure of forceps or by the manipulations of a breech delivery, they should be treated in the way already described with galvanic electricity. The result is usually good.

DISEASES OF THE EIGHTH NERVE

(Nervous Deafness, Aural Vertigo)

The eighth nerve is really two nerves, the auditory or cochlear and the vestibular nerve. The vestibular nerve has nothing to do with hearing. It carries sensory impulses starting in its nerve endings in the ampullæ of the semicircular canals and in the utricle. The inertia of the endolymph causes a varying pressure on these different nerve endings, corresponding to the different changes in the position of the head and to the motions of the body as a whole, thus arousing impulses for the special sense of equilibrium and bodily motion. As the two nerves, while distinct, are in the same sheath, and as the labyrinth is a continuous structure, disease affecting the one is practically certain to affect the other.

Accordingly two sets of symptoms occur together, as an indication of disease of these nerves or of their special endings in the labyrinth. Irritation of the cochlear nerve causes various subjective noises, while irritation of the vestibular nerve causes vertigo, which, when intense, is accompanied by vomiting, as in seasickness and in Ménière's disease. But, if the morbid process continues, what was at first mere irritation with irregular increase of function becomes destruction with loss of function. Accordingly, deafness is soon added to the subjective sounds, and when it has become absolute they generally cease. In the same way absence of any sense of motion gradually replaces the false sense of motion which ultimately entirely disappears. It has been noted of certain persons with total deafness that they are never seasick and cannot be made dizzy by being whirled in a revolving chair.

The treatment of the auditory symptoms of disease of the eighth nerve is only rarely successful even when begun early. Tinnitus is notoriously obstinate and the deafness is still more so. Patients generally come to the otologist when it is far too late for him to accomplish anything. Vertigo, on the other hand, often appears earlier than the tinnitus or deafness, and, being a symptom of irritation, of impending rather than actual destruction, it is, like pain, a symptom that can be alleviated and a valuable warning that something must be done. Moreover, it commonly brings the patient to the neurologist or internist instead of to the otologist, and

that is why the subject is treated here, instead of being left to works on diseases of the ear.

If the cause is intracranial, a tumor, abscess, aneurysm, or meningitis, other nerves, especially the seventh, will probably be involved, and the general signs of intracranial disease will be present, so as to make its location, and perhaps its nature, clear. An intracranial infection, especially syphilis or epidemic meningitis, may extend outward along the nerve and attack the labyrinth, usually on both sides at the same time or in rapid succession. Hence, these two diseases, along with scarlatina, which attacks the labyrinth from the opposite direction, through the throat and middle ear, are the prolific sources of deafness and deaf mutism.

The treatment of the cases starting within the cranium must be that of the primary disease, which is rarely successful, and even when successful in other respects very seldom restores hearing. In epidemic meningitis, however, the outlook, at least for prevention of disease of the labyrinth, is much better since the introduction of the antimeningitic serum. Lumbar puncture should be done early, and, if the cerebrospinal fluid is turbid, the serum should be injected immediately. In syphilitic cases the largest doses of mercury and potassium iodid that the patient will tolerate should be used as early as possible. If hearing is already lost, it will be regained in only a small proportion of cases. Chavanne advises that injections of pilocarpin, as described below, be added to the antisyphilitic treatment, so that, in the event of failure to restore what is lost, or even to save what is left of hearing, the physician can feel that the most intensive treatment has been employed. I know of no experiences with arsphenamin in such cases, but consider it contra-indicated, as in optic neuritis, on account of its tendency temporarily to increase congestion and swelling in an active syphilitic lesion. More frequent than the intracranial involvement of the eighth nerve are the cases in which the labyrinth is attacked from the peripheral side through the middle ear or temporal bone. In all such cases the most skillful and thorough and the earliest possible treatment by an otologist is imperative. In diseases like scarlatina, influenza, typhoid fever, and mumps most cases of serious disease of the ear could be prevented by careful attention to the nose and throat, repeated examination of the ears, and immediate treatment of otitis as soon as detected.

If there is no intracranial disease and no disease or injury of the middle ear or temporal bone, the symptoms are caused by disease within the labyrinth.

If the onset is sudden or acute we have to deal with hemorrhage, congestion, serous exudation, or inflammation. Here, again, we must think of syphilis as a possible cause of any of these pathologic conditions, for it attacks the labyrinth primarily as well as by extension. In case of doubt the treatment should be prompt and vigorous, as mercury and iodid

have a favorable tendency even in non-syphilitic cases. Gouty and rheumatic conditions, although generally chronic in themselves, often cause labyrinthine symptoms of acute or sudden onset. In any acute case perfect rest in bed in a quiet room is the first essential. Even turning in bed must be avoided or done slowly and cautiously. The first attack is often precipitated by a sudden turn. Derivation to the feet with a hot mustard foot bath may be employed at once, but the patient should not sit up. The bath can be brought to the side of the bed, and the patient should lie still, while the nurse immerses the feet. Free purgation with calomel and salines is desirable. Pilocarpin is not to be used in this stage. Even in gouty cases salicylates are to be avoided on account of their tendency to irritate the labyrinth. Later they may be used with caution. Colchicum may be given if otherwise indicated, because its tendency is toward intestinal irritation, which will do no harm. Bloodletting or blistering over the mastoid undoubtedly tends to relieve the internal congestion and should be employed. To relieve the intense distress, acetphenetidin and bromids are serviceable. If vomiting prevents their retention bromid may be given by rectum.

When the acute symptoms have subsided, if deafness and vertigo still remain, pilocarpin should be used hypodermically. This drug causes leukocytosis with free sweating, salivation, and diuresis, together with more or less nausea and prostration. The object is to secure the maximum absorption of exudate with the minimum of undesirable symptoms. The dose is gm. 0.01 to 0.02 (1/6 to 1/3 gr.) for an adult, but the first dose should be only gm. 0.005 (1/12 gr.) to test the patient's susceptibility. Children should receive the proportionate dose according to the usual rule. The dose should be increased until it causes free sweating, with salivation and perhaps some nausea. The time to choose is a few hours after a light meal. The patient must be in bed wrapped in blankets, and, after the sweating, must remain in bed for some hours at least, and be kept warm and dry. These injections are to be repeated every day or every other day according to the tolerance of the patient. If after twelve injections there is no improvement in hearing, the treatment should be given up. The deafness is incurable, although the vertigo may be greatly improved or have disappeared altogether (Chavanne). If there is some improvement the injections should be resumed, after a few days' interruption, and as many as thirty may be given altogether, after which no further good may be expected from them. If the pilocarpin should cause alarming symptoms, such as pain, diarrhea, vomiting, or dimness of vision, a hypodermic injection of strychnia, 0.002 gm. (1/30 gr.), and atropia, 0.0007 gm. (1/100 gr.), is the best corrective.

Chronic disease of the labyrinth is essentially incurable as far as the deafness is concerned, no doubt because the neurons of the cochlear nerve, having their bodies in the spiral ganglion, are partially or totally de-

stroyed. The sensory loss is analogous to that caused by destruction of neurons in the retina or in the posterior root ganglia. The further progress of the disease, however, and the liability to attacks of the Ménière type, should be combated by constitutional and symptomatic treatment. The gouty diathesis and arteriosclerosis are the constitutional conditions most commonly present. Free elimination by means of moderate doses of calomel and saline laxatives does much good. Salicylates, if otherwise indicated, may be used, but only in moderate doses and with extra caution. Potassium iodid may often be given with advantage, as it probably has some good effect on arteriosclerosis and favors absorption where that is possible.

The treatment of tinnitus and Ménière's attacks with massive doses of quinin, introduced by Charcot a generation ago, seems odd on first consideration, because such doses are well known to endanger even the healthy labyrinth. Charcot was led to try this by observing that, when deafness became total, the tinnitus and vertigo generally disappeared, so in his first cases he deliberately chose to sacrifice what little hearing might remain in order to relieve the other symptoms. This, of course, should be taken into account and the patient should understand its probable effects. Charcot gave gm. 0.5 to 1.0 (7½ to 15 gr.) daily for several weeks. His report of improvement in many cases was confirmed by others, and there is no doubt that this treatment may be advisable in certain cases, but it is far from being generally applicable (Frankl-Hochwart). The best medicine to relieve tinnitus and vertigo is some form of bromid or hydrobromic acid.

Galvanic electricity applied to the ear has been tried. While it can influence the labyrinth, as shown by the vertigo excited by moderate currents and the subjective sounds by very large ones, there is no proof that it does good. Thyroid extract has also been tried without success (Chavanne). Babinski has recommended simple lumbar puncture, and has found it to have a favorable effect, especially on the vertigo, rarely on the deafness. Its good effect on the vertigo has been confirmed by J. J. Putnam. Some of his patients had complete relief for many months after a single puncture, and relapses were relieved by subsequent punctures. In one of my cases of very severe labyrinthine vertigo which had resisted all other treatment there was very marked relief for a year following a single puncture. About 15 c.c. should be withdrawn and the patient should remain in bed for two days.

The general health must be built up by every possible means. The mental condition is one of great anxiety or depression, and should be treated as carefully as the physical symptoms.

NEURITIS OF THE NINTH NERVE

(Glossopharyngeal Paralysis)

Disease of the ninth nerve practically never occurs alone, but always with lesions of other nerves, especially the tenth and eleventh. The involvement of this nerve is recognized by disturbance of taste in the posterior two-thirds of the tongue, and difficulty in swallowing. What is said in the following section of the intracranial, cranial, and constitutional causes of vagus neuritis applies equally to this nerve. The treatment and prospects of success depend on the particular cause.

The difficulty in swallowing makes the affection a very serious one, and calls for extreme care in feeding the patient. Semisolid foods, custards, or preparations of milk thickened with flour, rice, or other forms of carbohydrate food, made more nutritious by the addition of eggs, are more easily swallowed than either solids or liquids. When these cannot be taken in sufficient quantity, milk and eggs must be given by a nasal or esophageal tube. Rectal feeding may be used to supplement this, but it is not sufficient alone. Thirst may well be relieved by enemata of normal salt solution, especially by the drop method.

Bernhardt recommends electrical treatment of the pharyngeal muscles.

NEURITIS OF THE TENTH NERVE

(Pneumogastric Paralysis)

The vagus in its long course is subject to many possible causes of disease or injury. In its intracranial course from the medulla to the jugular foramen the principal cause of disease is syphilis, but it may also, with adjacent nerves, be damaged by hemorrhage, tumors, aneurysm of the vertebral artery, or caries of the temporal or occipital bone. As syphilis is the most common of these intracranial causes, and is also far more amenable to treatment than any of the others, every means must be taken to decide whether or not it is present. In doubt, even while waiting for the report of a Wassermann test, mercury and iodid should be given in full doses.

In the neck the nerve is in danger principally from disease of the lymphatic glands, usually tuberculous, sometimes malignant. It is here also occasionally damaged by pressure from an aneurysm of the carotid artery. It may be involved in wounds of all kinds, and is not so very rarely injured in operations.

In cases in which the disease is caused by the pressure of tuberculous glands, surgical treatment may be supplemented by the use of tuberculin or the Roentgen ray, but, when nerves are involved, surgical removal of the glands is generally imperative.

In the chest the nerve may also be damaged by diseased glands, and it may be involved in pleuritis or pericardial exudate or in any disease of the mediastinum. The recurrent branch may be involved alone, and, as is well known, paralysis of the laryngeal muscles supplied by this branch is often the earliest recognized symptom of aneurysm of the aorta. Paralysis of the left recurrent laryngeal nerve may occur in mitral stenosis from the pressure of the dilated left auricle.

The vagus suffers, generally as a part of multiple neuritis, in various specific diseases, as diphtheria, influenza, typhoid fever, and pneumonia; also in intoxications, as alcoholism, phosphorus poisoning, arsenical poisoning, and plumbism. The indications for treatment in these cases are given under multiple neuritis, and also under the various original diseases.

An expert laryngologist may, with specially devised instruments, apply galvanism internally to the weakened laryngeal muscles. Or, as Bernhardt specially recommends, the easier percutaneous method may be used. In this method a button-shaped electrode, the cathode, is applied between the inner border of the sternomastoid muscle and the trachea, just below the cricoid cartilage, and is gently pushed backward. The other electrode may be over the thyroid cartilage on the other side. The current should be mild—1 to 3 ma. The faradic current can also be used, but in my opinion it ought not to be.

If suffocation is threatened by paralysis of the abductors of the vocal cords, either intubation or tracheotomy should be performed, preferably tracheotomy.

NEURITIS OF THE ELEVENTH NERVE

(*Spinal Accessory Paralysis*)

As the roots of this nerve come from the cervical cord the causes of its disease are to be sought first in the upper part of the spinal column. Pott's disease of the upper cervical vertebræ and tuberculous or syphilitic inflammation of the membranes of the cord are the conditions which may affect it here. In its course from the foramen magnum to the jugular foramen it may be affected by disease of the occipital or temporal bone or by meningitis, tumor, or aneurysm. Treatment is hopeful only when the spinal or intracranial cause is syphilis. In the neck it may be affected by disease of the lymphatic glands and by wounds and operations. In case of severance by wound or operation primary suture should be done, or, if this

has not been done, suture or anastomosis with another nerve may be attempted later.

The resulting paralysis of the sternomastoid is not a very serious matter but that of the trapezius allows the scapula to sag downward and forward on the chest so that the head of the humerus may press on the ulnar nerve or on the brachial plexus generally, thus causing pain, deformity, and serious impairment of the functions of the arm. This calls for special orthopedic apparatus to raise the shoulder and hold it back. Gaupp has devised such an apparatus for bilateral paralysis of the trapezius. In his case it relieved pain and allowed the arm to be properly used.

As long as there is hope of recovery electricity should be used in the two ways described under the Treatment of Neuritis in General.

NEURITIS OF THE TWELFTH NERVE

(*Hypoglossus Paralysis*)

The nucleus of the hypoglossus is affected in a number of central nervous diseases involving the medulla, but these do not concern us here. Peripheral disease is correspondingly rare. In its short intracranial course the hypoglossus is, like the other nerves at the base, liable to be damaged in hemorrhage, tumor, or inflammation. Its close proximity makes it fairly sure to be involved in case the occipito-atlantoid joint is diseased. After leaving the skull it is still more rarely affected, but even in its sheltered situation it is occasionally reached by a bullet or stab wound or compressed by a gland or tumor.

Little effective treatment is possible, and many cases end fatally from the accompanying conditions, but the same principles apply as in the case of other cranial nerves. Syphilis, if taken in time, can be cured. Suturing the nerve if severed by a bullet or knife is not necessarily beyond surgical skill. Electricity may be applied with one electrode directly on the tongue and the other over the great horn of the hyoid bone.

MULTIPLE NEURITIS

Treatment of Causes

While in mononeuritis the principal causes are local, and constitutional predisposition is generally only incidental, in multiple neuritis the converse is true, the principal cause is always constitutional, and local aggravations, if they exist, are only incidental. Nevertheless the constitutional cause in multiple neuritis does not, as one might naturally expect, act

equally on the nerves throughout the body. The peculiar symmetrical and peripheral distribution of the symptoms shows that there is a special predisposition in the neurons of the musculospiral and peroneal nerves and that this is greatest in those having the longest axis cylinders.

In any case of multiple neuritis the first step in treatment is toward the removal of the constitutional cause. This cause is usually a poison which may be introduced from without, as in alcoholic and arsenical neuritis, or be produced within the body, either through an error of metabolism, as in diabetic neuritis, or through the action of a living germ, as in diphtheritic paralysis.

The poisons from without the body that most frequently cause neuritis are alcohol, arsenic, and lead; those that may occasionally, but far more rarely, be encountered are ptomains, copper, mercury, carbon monoxid, carbon bisulphid, anilin and phosphorus.

Among the metabolic poisons that of diabetes is by far the most important. Gout is recognized as having considerable influence as a contributory cause, but Oppenheim doubts that any well-marked case has been due to it alone, and he also considers uremia a doubtful cause. In a very small number of cases gastro-intestinal disease or disease of the liver has been regarded as the cause. The cases caused by prolonged overexertion with exposure to cold, as in a swimming match, may be due to poison produced by changes in metabolism.

Of the infections diphtheria is clearly the most important, but it would be difficult to name an acute specific infection that may not cause multiple neuritis. Thus cases have apparently been caused by typhoid fever, influenza, epidemic encephalitis, scarlatina, puerperal fever, and other forms of septicemia, acute rheumatism, small-pox, whooping-cough, erysipelas and malaria.

Of the chronic infections leprosy has multiple neuritis as its most important symptom group. In the later stages of tuberculosis it is common to have the diagnosis of multiple neuritis suggested by pains, but not confirmed in the subsequent course by other signs of nerve lesion. In a much smaller number of cases, where a mixed infection is probably the chief cause, there is actual neuritis, as shown by loss of tendon reflexes, and atrophic paralysis.

Syphilis, a common cause of multiple lesions of the cranial nerves, is a rare cause of multiple neuritis affecting the spinal nerves, so rare that Oppenheim says that the diagnosis should always be made with great reserve.

Beriberi cannot be definitely classified as an infection or intoxication, as the cause is not entirely known, but it is symptomatically a form of multiple neuritis, and is caused at least in part by lack of the water soluble vitamin in the diet.

Finally, it is probable that mere defect of nutrition without infection

or intoxication may cause multiple degeneration of the nerves, as in some cases of severe anemia and cachexia.

These causes have been mentioned at some length because in treatment it is necessary to keep in mind the possibility of one of the rarer or more obscure causes being an important factor. Even when the main cause is certainly known it may not be sufficient to treat it alone, as there may be a combination of two or more constitutional causes in the same patient. Thus alcoholism, with its well-known lowering of resistance to infection, may be combined with rheumatism, pneumonia, influenza, syphilis, tuberculosis, or any other infectious disease. Gout is generally added to lead poisoning and often to alcoholism, while intestinal auto-intoxication may be an important complication of any case.

Alcoholism.—In cases of neuritis due to alcoholism, immediate and total abstinence from alcohol in all its forms should be the rule. This rule is often very difficult to enforce, not only in lighter cases where the patient is still able to go about, but also in cases of complete disability, unless the physician can control every person who has access to the patient. The tendency to deception, which is often most artful, and the great danger of continuous surreptitious consumption of alcohol must constantly be borne in mind, most of all when the patient is a woman.

Even in cases under complete control in a hospital it is wise to prescribe what will be regarded as a substitute and by quieting restlessness and irritability allay the intense craving for a stimulant, as in the following formula:

℞	Tr. opii deod.	3.0 (ɱ xlv)
	Tr. capsici	6.0 (ʒiss)
	Tr. nucis. vom.	15.0 (ʒiv)
	Elix. casc. arom.	20.0 (ʒv)
	Elix. calisayæ, q. s. ad.	60.0 (ʒii)

M. S.—Teaspoonful in water every three hours.

Should delirium tremens be present as a complication it is to be treated as if it existed alone, with rest, the necessary restraint, cautious use of sedatives and hypnotics, and careful feeding.[2]

Korsakow's psychosis requires no treatment except what is called for by the other conditions present in alcoholic neuritis.

Arsenical Poisoning.—In cases due to poisoning by arsenic the treatment as to cause depends essentially on preventing the further introduction of arsenic into the system. There may be considerable difficulty in ascertaining the source of the poison, as in the early cases of the great epidemic in England, where beer was made with glucose which had been made with sulphuric acid, containing arsenic as an accidental impurity. Gowers

[2] The reader is referred to Vol. III for a complete discussion of the treatment of alcoholism.—Editor.

notes the danger of a far smaller amount of arsenic in beer than can be taken with impunity in a bromid mixture prescribed for epilepsy, and suggests as an explanation that alcohol augments and bromid restrains metabolism in the nerves. It might also be said that the impure beer contained two causes of multiple neuritis. When the source of the arsenic is known it may require a change of occupation, as in the case of one of my patients, a metallurgist whose neuritic pains returned whenever he resumed his work after apparent recovery. The ores worked with contained arsenic, but as he had not known them to affect others it required not merely the chemical proof of arsenic in the urine, but also several returns of the pain to convince him that they were really the cause of his trouble.

Not a few cases of herpes zoster and some of multiple neuritis have been caused by the medicinal administration of arsenic. This has generally been in severe or obstinate cases of chorea in which long-contained administration or large doses have seemed necessary. In other cases it has been due to the patient ignorantly continuing the same prescription long after the physician, who has forgotten all about it, would have discontinued it. Every prescription for this or any other dangerous remedy should carry a written or printed prohibition to refill it after a certain date.

When the absorption of arsenic is stopped elimination usually goes on steadily without any special treatment. It may be hastened, however, by the administration of laxatives and iodid of potassium. As in mercurial poisoning the iodid should at first be given in very small doses in order to avoid putting too much of the metal in the circulation at once.

I have seen less than 10 gr. of iodid very greatly aggravate the pain of arsenical neuritis, which subsided when the patient, on his own account, discontinued the remedy, and promptly recurred when it was resumed. Only on dropping to 2-gr. doses, and gradually increasing, was it well borne.

Lead Poisoning.—In neuritis caused by lead the patient's occupation and habits usually leave no doubt as to the source of the poison. But in some cases, even when the line on the gums or the presence of lead in the urine makes the cause certain, the mode of its introduction is very hard to determine. In these cases drinking water, medicines, especially hair restorers and other cosmetics, and all the substances with which the patient is habitually occupied must be under suspicion until proved innocent or the source of the poison is definitely known. An infinitesimal amount regularly absorbed for a long time will eventually bring disaster. The old books tell of a seamstress who was poisoned by habitually biting thread in the glazing of which lead was used.

If the patient's occupation involves the use of lead, as in painting, the danger may be minimized by carefully cleansing the face, hands, and

nails, especially before eating, avoiding work in which the air breathed may be contaminated, as in painting ceilings or working in the dust of lead ores, frequent bathing of the entire body, wearing none but clean clothing next the body at any time, changing clothing as soon as work is over for the day, and using the sulphate of sodium or magnesium as a laxative. But if the nerves are already involved at least an interruption of work will be necessary.

To favor elimination potassium iodid should be given, beginning with small doses and gradually increasing. As gout and nephritis are frequent complications of plumbism the action of the kidneys, particularly in the elimination of uric acid, should be favored in every way possible.

Diabetes.—The causal treatment of multiple neuritis due to diabetes includes all the measures that may be used to combat this disorder of metabolism, which is necessarily exceedingly grave when it causes neuritis. These measures are systematically considered in another part.

Infections.—The treatment of various infections which may cause multiple neuritis is given in special articles. The great thing is to recognize infection as the cause and to find and remove the primary source. The occurrence of neuritis calls especially for elimination and support. Gowers strongly recommends tincture of iron in doses of 20 to 30 minims.

Treatment Irrespective of Cause

In discussing the treatment of multiple neuritis itself, irrespective of cause, it is convenient to follow Goldscheider and divide the disease into three stages: (1) the stage of advancing muscular paralysis; (2) the stage of arrest; (3) the stage of convalescence and regeneration.

Diet.—In all forms of multiple neuritis and in all stages the food should be as abundant and as rich in proteins and fats as the patient's powers of digestion will permit. It should be given in moderate quantity from four to six times daily rather than in a large amount three times a day. In the diphtheritic form special difficulties in feeding the patient are likely to be encountered because of the frequent paralysis of the muscles of deglutition. If only the palate is paralyzed so that the principal difficulty is regurgitation of food through the nose the patient may get along fairly well with semisolid foods, such as custards, puddings, eggs in various forms, cottage cheese and pap; these being easier to swallow than either solids or liquids. If the pharynx or epiglottis is paralyzed the taking of food of any kind becomes both difficult and dangerous. When enough can no longer be swallowed the nasal or esophageal tube must be used without delay, as a fatal weakness of the heart and respiratory muscles is likely to come on rapidly as soon as the amount of food is insufficient. On account of this danger the patient's emotional state is of the greatest importance and the physician must use his utmost skill and tact to

conduct the feeding process so as to occasion the least possible distress or alarm. Rectal feeding of peptonized milk may be used to supplement that by the stomach, but is far inferior and can supply only a fraction of what is needed to make good the losses of the body.

Elimination.—If an abundance of food is to be taken in a disease caused by a poison free elimination is obviously necessary. Small doses of calomel with tonic and saline laxatives should be used to secure sufficient action of the bowels, but without such a degree of purgation as will weaken or interfere with rest. Salicylate of sodium is particularly useful as a diuretic in all gouty or rheumatic cases. It should not be given in solution, as in this form it always becomes repulsive in a short time on account of its effect on the mouth and pharynx. If given in tablet form immediately before food it will almost always be borne perfectly well by the stomach. Plenty of water should be taken for its diuretic action.

Tonics.—Strychnia is especially indicated on account of its influence in increasing appetite and digestion, its tonic effect on the heart and respiration, and its general tendency to stimulate motor neurons. Its dose is gm. 0.002 (1/30 gr.) three or four times daily. If the heart is weak and rapid digitalis should also be given, gm. 0.05 to 0.1 (¾ to 1½ grains) of the powdered leaves, or 8 to 15 minims of the tincture, three or four times daily. If respiration is threatened atropia hypodermically, gm. 0.0007 (1/100 gr.), will tend to sustain it. It may be given every four to six hours.

Rest.—In the first stage rest is by far the most important desideratum. Every muscular contraction presses upon and irritates the nerves, thus hastening the destructive process as well as increasing the pain. Even in the lightest cases, where it is very difficult to induce the patient to submit to confinement, there is a great probability that efforts to keep up as long as possible will prolong the disease. In all but the lightest cases rest should be in bed, and as nearly absolute as possible. If the heart and respiratory muscles are seriously weakened the patient ought not even to sit up in bed. This is especially important in the diphtheritic cases, where the danger of sudden death from cardiac failure is considerable.

Warmth.—In the first stage thermal rest is as important as mechanical rest. Cold is depressing, uncomfortable, and dangerous to the tissues. A hot-water bag or poultice, which is hot enough to be barely endurable by healthy tissue, is too hot for an inflamed nerve or its distribution, and involves the risk of blistering or even of deep sloughing. Moderate warmth as nearly equable as possible is most soothing and most favorable to subsidence of the inflammation. Warmth with moisture may be obtained by wrapping the limbs in cotton and covering this with oiled silk, rubber tissue, or paraffin paper, the whole retained by a roller bandage just tight enough to stay in place. If the natural warmth of the limbs thus band-

aged is not sufficient external heat may be added cautiously by means of a hot-water bag or any convenient heated object, provided this is carefully insulated from the skin and is not hot enough to burn if the coverings should accidentally be displaced. Later, as the more acute symptoms are subsiding, dry warmth is preferable and may be secured by omitting any waterproof material from the bandages and changing the cotton as often as it is moistened by perspiration.

Posture.—In the most painful stage the position of greatest ease is naturally chosen: thighs slightly flexed and rotated outward, knees slightly flexed, feet at right angles to the legs, arms slightly abducted, elbows slightly flexed, arms between pronation and supination or slightly pronated, wrists and proximal phalanges extended, distal phalanges semiflexed. This posture is to be maintained without active effort by means of skillfully adjusted pillows of varying size. From the beginning the tendency to foot-drop and wrist-drop and to these deformities becoming fixed must be borne in mind. The feet may be supported in proper position by a large sandbag, 9 inches in diameter, placed transversely, or by a board fastened across the bed. The slight pressure needed to support the feet should come upon the ends of the metatarsal bones. The feet must be protected from the pressure of the bedclothes either by the arrangement of pillows or by a specially devised wire frame. At first the sandbag or board will support the feet more comfortably than any dressing, but later it may be more convenient to use the apparatus devised by Gowers. As pain subsides the semiflexed position of the hips and knees should be changed to that of full extension, otherwise the resumption of walking will be much delayed by contraction of the flexor muscles. This change in posture causes a little distress at first, but with patient persistence can be managed without much discomfort. To prevent fixation of any of the joints passive motion should be begun as soon as it can be carried out without causing severe pain at the time, or more than slight pain persisting for a short time after the manipulation. The feet are to be dorsally flexed, the wrists and fingers extended, and so on, but all the motions must be carried out slowly and with extreme gentleness. If one manipulation causes a definite increase of pain, or makes the patient dread the next, it has been overdone.

Pain and Insomnia.—The measures already described tend strongly to relieve spontaneous pain, but in most cases enough will remain to require additional relief by means of analgesics or narcotics, as described in the Treatment of Neuritis in General. These should be used sparingly, but the relief should be adequate, especially at night. When sleep is prevented by pain opium or one of its derivatives is the best hypnotic.

In the early stage of acute pain and advancing paralysis massage and electricity ought to be omitted entirely. Bathing should be limited to the tepid sponging necessary for cleanliness.

Massage.—After the advance of the disease is arrested and pain has subsided massage should be begun. At first it should be merely a gentle superficial upward stroking of the limbs, but as tolerance is ascertained the rubbing may reach the deeper tissues so as to favor the flow of lymph and venous blood toward the trunk. The passive motions already begun can now be combined with massage and made more vigorous. If any muscles, especially the calf muscles, show a tendency to shorten they should be stroked to favor their relaxation while being stretched by the appropriate passive motion.

Electricity.—Galvanic electricity may be used with advantage during the second stage. It is essential that each group of muscles as it is treated should be relaxed by posture and thus be free to contract. The pole on the muscles should be the one which causes the greater contraction, either negative or positive, the current should be slowly made and broken and strong enough to cause fairly vigorous action.

Convalescence.—In the third stage electricity, massage, and passive movements are to be kept up until returning motor power and active exercises render them unnecessary. In sitting foot-drop must still be guarded against by seeing that the ball of the foot is supported while the heel is free to drop. If the calf muscles still tend to shorten they can be stretched by attempts to stand and walk. As soon as the patient is able to walk at all they generally yield and improvement goes on rapidly. Warm baths favor relaxation. In only a few cases will section of tendons be necessary. The open air, tonics, food, recreation, and remedies to favor digestion and elimination will naturally be suggested. Finally, as in other cases of long-continued illness, convalescence can often be hastened and made more complete by change to some agreeable place in a climate which favors outdoor rest and recreation.

In the alcoholic cases the period of ultimate recovery should be utilized by the physician in explaining and urging upon the patient the necessity of total abstinence for the rest of his life. He must learn how, as a matter of habit, to ignore the existence of alcohol altogether, avoiding even the resolutions and protestations that he will not drink, because they awaken the dormant appetite.

LANDRY'S PARALYSIS

(*Acute Ascending Paralysis*)

This is a febrile disease, of acute onset, marked by flaccid paralysis beginning in the lower limbs and ascending, in the fully developed cases, through the trunk to the arms, then in the fatal cases to the diaphragm and the muscles of the tongue, pharynx, and larynx. Sensory loss is

absent or limited to a slight dulling of sensibility below the knees. There is no severe pain and constitutional disturbance is comparatively slight. The muscles show no conspicuous atrophy or decided change in their electrical reactions. Control of the sphincters is retained. After death no gross lesion can be found in the cord or nerves.

It follows from this that the disease is different from myelitis, poliomyelitis, or multiple neuritis. It is a practical certainty that it is an infection whose toxin has a selective effect on the anterior horns or the motor roots, but the microörganism has not yet been identified.

In the present state of knowledge there is no efficient treatment, although we hope that bacteriology will indicate a remedy in the not distant future. In the meantime, on account of its tendency to sterilize the fluids of the body, it seems more rational to give hexamethylenamin than any other drug, gm. 0.5 (7½ gr.) four times daily. Strychnia is also rationally indicated, gm. 0.002 (1/30 gr.) four times daily. Strümpell recommends aspirin or sodium salicylate, at the beginning in large doses. He also recommends mercurial inunctions used cautiously. Ergotin is well spoken of by Oppenheim, but regarded as useless by Buzzard. Counterirritation, by blisters or even the Paquelin cautery, has been recommended, but I would omit it. From the beginning the most perfect rest and comfort should be secured. The bowels should be opened and the catheter used if necessary.

When death comes it is through respiratory paralysis. Therefore, care should be taken to prevent or cure even a slight bronchitis. When respiration is embarrassed atropin should be added to the strychnin both to stimulate the respiratory center and to check bronchial secretion, gm. 0.0003 to 0.0006 (1/200 to 1/100 gr.) four times daily. Toward the end life may be prolonged by artificial respiration and oxygen. When the danger to life is passed there is but little need of treatment but galvanic electricity, passive movements, and massage may be indicated to hasten convalescence.

POLYMYOSITIS

Excepting the familiar muscular rheumatism and trichiniasis, primary diseases of the muscles are rare and comparatively little known. Of recent years, however, cases representing a group of diseases have been collected and described under the general name polymyositis, the essential lesion being inflammation of a number of muscles. For a general account the reader is referred to Senator, Strümpell, Oppenheim, and especially Steiner. In all of these treatment will be found the least satisfactory phase of the subject.

The purulent form of polymyositis is a multiple acute inflammation of the muscles, beginning like an acute infectious disease and ending in

the formation of abscesses in the muscles. The Staphylococcus pyogenes aureus has been found far more frequently than any other germ, sometimes in a pure culture. The non-suppurative forms include polymyositis hæmorrhagica, in which there are hemorrhages into the inflamed muscles; dermatomyositis, in which both the muscles and the skin and subcutaneous tissue covering them are inflamed; and neuromyositis, in which some of the nerve trunks are involved.

The treatment of all of these conditions is substantially the same as that of multiple neuritis, the modifications depending on obvious indications. In the first stage rest as complete as possible and elimination through laxatives, diuretics, and diaphoretics are the important objects. Pain should be combated, first with salicylates, as in acute rheumatism. Aspirin is the favorite salicylate now on account of its diaphoretic property. Other pain-relieving drugs are to be used on the same principles as in neuritis. When the fever is high cool sponging should be employed, later warmth will be better. In the purulent form pus should be evacuated as soon as detected. Whether a vaccine can be employed to advantage in these cases must be determined by the degree of absorption that is already going on, and the probable power of the patient to respond to an additional demand on his immunizing forces. The indications as to posture, passive motions, massage, electricity, and care during convalescence are precisely the same as have been considered in detail under Multiple Neuritis.[3]

REFERENCES

Since Chapters IX, X, and XI are so closely related, the references for all three chapters have been combined in a single list at the end of Chapter XI, page 366.

[3] I have seen 1 case of dermatomyositis which recovered after most liberal inunctions of Credé's ointment.—Editor.

CHAPTER XI

THE NEURALGIAS

Howell T. Pershing

NEURALGIA

The term "neuralgia" has been used so loosely to designate pains having a very different origin from those of true neuralgia, and hence requiring very different treatment, that it is necessary at the outset to understand what is meant by it.

Neuralgia is here understood to mean pain felt definitely in the course or distribution of certain nerves, occurring in paroxysms, with intermissions or at least marked remissions, and not directly due to recognizable organic disease or to another neurosis such as migraine, epilepsy, hysteria, or occupation neurosis. The paroxysms are excited by exceedingly slight sensory stimulation and between them relief is generally complete; only in very rare cases is there persistent soreness between violent paroxysms. Continuous pain is not neuralgia. True neuralgia is a unilateral disease and the great majority of the trigeminal cases are on the right side. It is not claimed that any definition will enable us always to discriminate between true neuralgia and the various organic and functional diseases that may resemble it, but the distinction must be kept in mind in discussing the value of different modes of treatment.

Neuralgia may affect any sensory nerve, so we have different neuralgias named according to the location of the pain. All of these are nearly alike in the broad features of etiology and treatment, and to avoid repetition the measures generally applicable will be discussed first, those specially applicable to certain localities coming afterward. Trigeminal neuralgia is the most typical form, and what is said of neuralgia in general applies especially to it.

Treatment as to Cause

Writing of the causes of neuralgia now must show a lack of precision just as it did to write on the causes of acute articular rheumatism

before anything definite was known of the streptococcus as the infecting agent or of the tonsils and other organs as points of invasion. A definite and constant cause of neuralgia not being known, we are obliged to consider a large number of possible causes without being sure of the relative importance of any. It is clear that the sensory nerve cells involved are so changed that a very slight stimulus from the periphery excites violent pain, and it also seems clear that this change is in the peripheral neurons whose bodies are in the gasserian ganglion or in the posterior root ganglia. What causes the irritability we do not definitely know.

Our most valuable means of treatment, injection of alcohol, merely blocks the sensory currents from the periphery, thus shielding the ganglion from disturbance, but also sacrificing the normal function of the nerve. What we ought to be able to do is to reduce the excessive irritability of the neurons so that they would respond normally to ordinary stimuli; and this can be done only by removing the cause. Until the cause is known we must try to remove all possible ones.

Local Causes.—After a thorough anamnesis and general examination a careful and systematic search for local causes of irritation is to be made. Such a cause is more likely to be found in the distribution of the branch most affected, but it may be in that of another branch, or possibly even in that of another nerve. In the eyes inflammation of any part should be looked for and the state of refraction and muscle balance ascertained. The condition of the nose and its adjacent sinuses, of the external and middle ear and of the tonsils should be investigated. But it is defect of the teeth that is most likely to be in causal relation to the pain, and they should be examined carefully in systematic order. It will be necessary to get Roentgen ray films if there is any question of faulty eruption or suppuration at the roots. The physician must be sure that the dental examination is thorough. Patients have assured me that there could be nothing the matter with the teeth, as the mouth had just been thoroughly examined, and yet on sending them to a dentist of my own selection most important lesions have been found.

If a source of irritation or infection is found it should be carefully considered and removed. In some cases, especially the more recent, less typical and less severe ones, this alone may effect a cure, but in the older cases and those of typical *tic douloureux* not too much should be expected. On the whole it seems to me that in this disease the curative effect of removing peripheral irritations has been greatly exaggerated. A few striking but exceptional cases have been the basis of a generalization without taking into account a far greater number that would point to a different conclusion. Sound teeth should not be extracted no matter how definitely the pain is referred to them, nor how decided the patient may be in wishing to have them out. If a sound tooth is extracted the pain persists unchanged or increased, or after a brief inhibition returns, probably worse

than ever, and may still be referred to the socket of the absent tooth years later. Similarly a certain degree of caution and skepticism should govern in treating ocular defects supposed to be the cause of trigeminal neuralgia. By all means let the eye be put in the most perfect condition possible, with a reasonable amount of examination and treatment, but it is unwise to lay much stress on slight variations of refraction or muscle balance in a neurotic patient, and as a consequence to keep making changes in the glasses at short intervals. Local irritations or sources of infection in the viscera of the chest, abdomen, or pelvis are very difficult to interpret as possible causes of neuralgia, but the examination should be sufficiently thorough to detect them if present, and as far as possible they should be corrected.

Systemic Causes.—These are generally more important than the local or reflex causes. Anything that debilitates or poisons the system may be the principal predisposing cause of the excessive irritability of the sensory ganglia causing the pain. The outlook is the more hopeful the more definite and adequate such cause may be, provided it is amenable to treatment. Anstie's famous epigram, "The pain is the cry of the nerve for better blood," may be true in either of two distinct senses: the cry may be for richer blood or simply for blood unloaded of its impurities.

The various forms of anemia are to be treated with a generous diet, iron, arsenic, and other tonics and regulation of the bowels. Arsenic should be given in small doses except in the more severe forms of anemia, and preferably as sodium cacodylate. Gowers warns against a vegetable diet. He says:

"A good supply of animal food is of great importance for all but gouty subjects. I have known severe neuralgia to occur first on the patient commencing a purely vegetable diet, to disappear when meat was taken, and recur with severity at each of four attempts to return to vegetarianism."

The diet of all debilitated patients should be rich, not alone in proteins, but also in fats, of which butter, cream, and cod-liver oil are the best. Small doses of phosphorus have been of distinct advantage in a small proportion of cases.

Arteriosclerosis and the defective nutrition due to advanced age strongly predispose to neuralgia. They are naturally most resistant to treatment, but potassium iodid and the vasodilators, sodium nitrite or glonoin, do some good.

In patients who are run down rest is most important. Generally moderate activity with adequate periods of rest is better than idleness, but unfortunately many patients cannot rest, although having abundant time for it. In these restless, irritable patients small doses of opium, gm. 0.01 to 0.02 (1/6 to 1/3 gr.), three to four times daily, added to the tonic

given and combined with enough aloin, gm. 0.002 to 0.005 (1/30 to 1/12 gr.), to overcome the constipating effect, will be of great advantage. In some cases the systematic rest cure as devised by S. Weir Mitchell should be carried out.

Recent Rheumatic Cases.—In the acute cases of recent origin, apparently caused by exposure to cold with rheumatic infection, warmth, both local and general, is indicated, together with moderate purgation, diuresis, and diaphoresis. Sodium salicylate or its equivalent among the salicylates available acts almost as a specific. Aspirin is valuable in acute cases because it promotes free sweating, but it is more irritating to the digestive organs than sodium salicylate or salophen. Its dose is gm. 0.3 to 1.0 (5 to 15 gr.) three or four times daily. The old-fashioned pulvis ipecac. et opii, gm. 0.65 (grs. x), at bedtime, with a hot foot bath, is appropriate at the beginning of such a case.

Gout.—The gouty diathesis is a very frequent chronic predisposing cause of neuralgia, and it is reasonable to suppose that the same chemical substances which commonly irritate the joints may cause neuralgia by a direct or indirect irritation of sensory neurons. All such patients should avoid alcohol and foods rich in nucleins, such as sweetbreads, liver, and kidneys. The liver and intestine must be kept active and a salicylate should be given up to the limit of easy tolerance. I have found the salicylate of sodium far more useful than any other drug. Aspirin is highly efficient. If, however, there is doubt as to the patient's tolerance salophen can be given in the same dose as sodium salicylate, from four to six times daily, irrespective of food, with assurance that it cannot disturb digestion.

Other Intoxications.—Alcoholism, diabetes, lead poisoning or the underlying cause of arthritis deformans may be the systemic cause of neuralgia. They are treated in special articles in other parts of this work.

Specific Infections.—Influenza is the most important of the acute infectious fevers. It should be treated like the acute rheumatic form, but with extra care to secure the most absolute rest possible and to prevent a relapse, which is easily caused by going out before recovery is complete. Of the chronic infections malaria is especially apt to affect the supra-orbital branch so that, in some regions, "brow-ache" is an old synonym for malaria. It should, of course, be treated by the prevention of mosquito bites and such doses of quinin and arsenic as may be necessary. Syphilis, although it is more apt to cause neuritis than true neuralgia, is a not uncommon cause of intercostal or supra-orbital pains, mostly nocturnal, that cannot at first be distinguished from true neuralgia, and urgently demand specific treatment. One must remember, however, that neuralgia may exist in a syphilitic patient without being kept up by syphilis, and so mercury, iodid, and arsphenamin must not be given too freely in a vain attempt to prevent the attacks. Pains caused by the late syphilitic

diseases, tabes and paretic dementia, are in a different category from active syphilis, on the one hand, and true neuralgia, on the other. Iodid of potassium in moderate doses may be of considerable service in patients with neuralgia who are not syphilitic. Arsenic also may be useful in patients who are neither anemic nor malarial; it should be given as sodium cacodylate.

Mental Condition.—The emotional condition of the patient is important. Grief, anger, fear, and other depressing emotions may precipitate attacks, and, conversely, exhilarating and cheerful influences may relieve or prevent them. Professor W. B. Carpenter has told how attacks of severe trigeminal neuralgia often occurred about the time of his lecture on physiology, making him feel that it would be impossible for him to deliver it. He generally did deliver it, although with very great effort at the beginning, and as he became more and more interested the pain commonly disappeared. At the end of the hour it sometimes returned, but often it did not.

Climate.—Many neuralgic patients are plainly influenced by climate, season and weather. They suffer especially when storms are approaching from the west and in cold damp weather with rapid changes of temperature. When one can choose, a dry, warm climate is to be preferred, but in any climate the neuralgic patient should have an apartment that can be properly warmed.

Relief of Pain

Electricity.—Our profession is not unanimous in regard to the value of electricity in neuralgia. My own success with it, except in cases that have yielded readily to other lines of treatment, has been insignificant. Nevertheless, so many of the best observers testify to its value that it cannot be ignored.

The galvanic current is to be chosen in preference to faradic or static electricity. It has been shown that it may lessen the irritability of sensory nerves, and experience proves that it is the most useful of the three. The anode, about 4 cm. or 1½ inches in diameter for the face, soft and well moistened with warm salt solution, is gently applied to the seat of pain, while the cathode, which may be of any convenient size, is applied to an indifferent place, as the back of the neck or the chest. After the electrodes are properly placed the connection is to be made and the resistance of the rheostat slowly and smoothly diminished so as to increase the current very gradually until the desired strength is reached; then it is allowed to flow steadily for a few minutes and gradually reduced to zero before removing the electrodes. At the first sitting a maximum current strength of 1 ma. for each square inch of skin touched by the active electrode, or for each 6 sq. cm., will be sufficient. At later sittings the current density may be two or three times as great and the time of application

may be increased. Where the painful area is large a correspondingly larger active electrode should be used and the current made stronger in proportion to its area. In general the weaker currents applied for a long time, ten to thirty minutes, succeed best. This treatment should not be undertaken without a suitable rheostat and milliammeter. Sudden variations or excessively strong currents may very greatly aggravate the pain, and even its careful and skillful employment occasionally does harm. The more sensitive the patient is to peripheral excitation, as in talking, eating, or touching the face, the greater the need of caution.

In the inveterate cases of tic douloureux, where many remedies have been tried without success, I do not think it worth while to try electricity. In recent cases, if there is a possibility that the pain is that preceding an eruption of herpes zoster, electricity, together with all irritating applications, should be avoided; otherwise the eruption may be attributed to an error in treatment.

Drugs to Relieve Pain.—These are always necessary at some stage of the case, and must often be employed in advance of any effort to remove causes. Their justification is not merely the relief of present suffering, although this would generally be sufficient; when successful they at least tend to prevent future attacks and so contribute toward a possible cure.

One of the coal-tar analgesics should first be tried. Acetphenetidin (phenacetin) is perhaps the best of these, and may be given in a single dose of gm. 0.50 to 1.0 (7½ to 15 gr.), maximum in one day gm. 2.0 (30 gr.). The larger doses are often necessary, and Byrom Bramwell has given as much as gm. 2.0 (30 gr.) at once. Such doses are not devoid of danger unless the smaller ones have first been tried and their effect upon the heart and the condition of the blood carefully noted, with due regard to the age and general condition of the patient. Nevertheless this is a disease in which well-considered and carefully guarded risks are often justifiable, and remedies of this class carefully used are not so dangerous as many others, for example, aconitin or the larger doses of morphia. The maximum dose must not be repeated within at least twelve hours. The danger of failure of circulation is minimized by rest in bed and the administration of strychnia or quinin.

Instead of acetphenetidin antipyrin may be given in twice its dose, gm. 1.0 to 2.0 (15 to 30 gr.), maximum in one day, gm. 4.0 (60 gr), subject to the same precautions, or acetanilid, gm. 0.3 to 1.0 (5 to 15 gr.), maximum in one day, gm. 1.5 (23 gr.). Salipyrin and pyramidon have a similar action and may be used instead. The dose of salipyrin is the same as that of antipyrin, of pyramidon the same as of acetanilid.

Butylchloral hydrate has been strongly recommended by Liebreich as having a specific anesthetic effect on the trigeminus in doses too small to affect the heart or respiration or even to cause sleep. Others

have controverted his statement, but Oppenheim has sometimes found it sufficient in small doses. It may be given as follows:

℞	Butylchlorali	5.0 (ʒi, xv)
	Glycerinæ	15.0 (ʒiv)
	Alcoholis	15.0 (ʒiv)
	Aquæ, q. s. ad	60.0 (ʒii)

M. et S.—ʒi in water every ten minutes until relieved or six doses are taken.

Aconitin, the crystallized alkaloid of aconite, has been successfully used by some physicians. It is given in doses of gm. 0.0001 (1/640 gr.) at first every half hour until four doses are taken. If this is not sufficient it may be cautiously increased each day until the maximum daily quantity of gm. 0.002 (1/32 gr.) has been reached. The patient should rest in bed and the effect on the circulation should be most carefully observed. There is no doubt that given in this way aconitin may, for a time at least, control even severe tic douloureux, but it is a powerful poison, and these doses, even though cautiously administered, are somewhat dangerous to life. I have never had the courage to give it a thorough trial and cannot recommend it.

If some of the foregoing remedies are not sufficient an opiate should be added to the coal-tar analgesic. The safest, although the least efficient, is codein. It very slightly increases the danger, but will often do good service in doses of gm. 0.03 to 0.13 (½ to 2 gr.). If this is not sufficient the extract of opium, gm 0.02 to 0.07 (1/3 to 1 gr.), or morphia, gm. 0.01 to 0.03 (1/6 to ½ gr.), should be substituted for the codein. If the pain defies these milder measures, rather than resort to the very large doses of opium, such as Trousseau recommended in the worst neuralgia, it will be better to give morphia hypodermically until a more radical treatment is carried out. The pain antagonizes the effect of morphia so that increasing and ultimately very large doses may be necessary, but the initial hypodermic dose must be small, gm. 0.006 to 0.01 (1/10 to 1/6 gr.).

The patient must, of course, not have the syringe in his own hands, and if he happens to be a physician he should be required to give his own hypodermic case into the care of some one else, no matter how inconvenient it may be. When morphia is required daily it is time to decide upon more radical treatment.

Aside from the drugs which fulfill a distinct causal indication, and those already mentioned, very many others have been recommended as valuable in the treatment of neuralgia. Bernhardt remarks that a writer loses courage as soon as he attempts to make even a brief mention of them. Vanlair gave over one hundred and fifty in the first edition of his book, in 1866, and the number has been greatly increased since then. The best

that can be said of most of them is that in a very small proportion of cases they have seemed to be helpful. Many, no doubt, owe their recommendation to having been used in cases of hysteria simulating neuralgia, or to having been administered in true neuralgia when a remission was about to occur from other causes. Unhappily there are many cases of neuralgia in which the pain has returned again and again in spite of all medical treatment.

Injections for Trigeminal Neuralgia

The treatment and prognosis of severe trigeminal neuralgia have been greatly improved by the simplified methods of injecting alcohol into the nerves. The evolution of the method has been gradual, yet rapid, and constitutes one of the most gratifying advances in treatment.

Almost from the introduction of cocain as a local anesthetic Gowers insisted on the great relief to be obtained in neuritis and neuralgia from its hypodermic use. He employed it in the distribution of the nerve and especially in the most painful areas as close to the nerve trunk as possible. Although the relief was only temporary and the injection had generally to be repeated once or twice daily he believed it helped toward a permanent cure. Others no doubt would have used cocain more freely in this way were it not for the depressing after effects and the danger of the cocain habit.

In the effort to get more lasting relief a number of more or less destructive substances were tried, including chloroform, ether, carbolic acid, and osmic acid. All of these had some success, and the injection of a 1 to 2 per cent solution of osmic acid, in the hands of Bennett in England and Murphy in this country, was a distinct improvement on the operations of section and avulsion which it replaced. Relief was generally prompt and lasted for months or even years. Its disadvantages were that it was still necessary to do a formal operation to expose the nerves and that the osmic acid caused necrosis of any tissues it touched, even bone, thus favoring subsequent infection and suppuration.

In 1903 Schlösser, of Munich, described a method of injecting the branches of the trigeminus with alcohol at their exit from the cranium. He had tried injections at the supra-orbital, infra-orbital, and mental foramina and, thinking he would be more successful if the nerve trunks could be reached central to their important branches, he devised a method of injecting the third branch at the foramen ovale, the second at the foramen rotundum, and the lacrimal and frontal branches of the first as they enter the orbit at the sphenoidal fissure. He used a specially constructed bent needle for each branch and introduced it through the mouth. Schlösser's method was practiced in France by Ostwalt, and has been followed by Kiliani and Hauck in the United States. The difficult technic of

Schlösser was simplified and made much easier by Lévy and Baudouin, and their modification has been used with success by Harris in England and was introduced in this country by Patrick, who was followed by Hecht and Bodine and Keller. The method of Lévy and Baudouin has now been tested by many operators in all parts of the world, and there can be no doubt of its great value.

Solutions: The local anesthetic should be novocain (procain) with suprarenin in 2 per cent strength in Ringer's solution. The Ringer's solution is first thoroughly boiled and, on adding the tablets, just before using, it is again boiled for a few moments. This can be used more freely than cocain and is entirely satisfactory if enough time is given for its absorption. The alcohol has usually been employed in a strength of 80 per cent, but if the local anesthetic has been injected in sufficient quantity 95 per cent is better, for it will be diluted by the anesthetic. Chloroform and other substances sometimes added to the alcohol are unnecessary.

Alcohol injected into a nerve attacks it chemically and causes complete degeneration of all axis cylinders and medullary sheaths peripheral to the injection, leaving only the neurilemma. It thus accomplishes just what section would do in preventing impressions from the periphery from acting on the irritable nerve ganglia. Some influence is also exerted centralward upon the ganglion cells, for in experimental injections into the nerves of animals these cells show chromatolysis, but whether this has anything to do with the relief of pain is uncertain. If the injection is not into the nerve, but near it, the same effect may be produced, but with less certainty. Alcohol is strongly antiseptic and, while this should not cause any laxity as to asepsis, it affords a very comfortable additional security against infection. It is not necessary to expose the nerve, and the necessary punctures leave no scars. A general anesthetic is not necessary, as the pain is not hard to bear in comparison with a paroxysm of neuralgia, and lasts only for a few moments, after which there is complete local analgesia. The patient remaining conscious and reporting his sensations, the operator knows when the nerve is struck. It may require several trials, however, before the nerve is thoroughly infiltrated and the full degree of analgesia attained. These attempts may be repeated at intervals of a day or two. It is essential that every superficial area whose irritation can excite paroxysms of pain be rendered analgesic, whether by deep or by superficial injections. The relief of pain is usually immediate and, if the nerve is well injected back of the origin of any painful branch, the relief lasts from a few months to a few years, on an average about nine months, which is longer than that obtained by section and fully as long as that obtained by the use of more destructive substances such as osmic or carbolic acid. When pain recurs, as it will, it is as easy to make the injection again as it was

at first, there being no change in the relation of the parts and no scar tissue.

Injections at the Superficial Foramina—*Supra-orbital Branch.*—The supra-orbital notch may generally be felt at the junction of the inner third with the outer two-thirds of the upper margin of the orbit. After cleansing the skin with alcohol and ether and perhaps painting it with iodin, the finger is placed on the notch and the needle of a Luer or Record syringe, containing the novocain solution, is inserted above the finger as accurately as possible into the notch and 10 drops injected. After waiting ten minutes from 10 to 15 drops of alcohol are injected. If not sure of the notch one should probe with the needle just above the margin of the orbit in the endeavor to find a possible foramen. If still not sure the alcohol can be injected a little at a time at a series of closely adjacent points on the bony margin.

Supratrochlear Branch.—The cutaneous area supplied by this nerve, the upper part of the side of the nose, may be a pain-exciting zone. If so the branch must be separately injected. Patrick says:

"It may be reached at a point about midway between the inner canthus of the eye and the eyebrow on a line running upward and inward at an angle of about 45 degrees. This sounds indefinite, but I have never failed to get it."

After piercing the skin the needle is to be moved slightly to one side or the other of the line and the characteristic numb pain on the side of the nose will tell when the injection is being made at the right point.

Infra-orbital Foramen.—Draw a line from the supra-orbital notch to the second bicuspid tooth in either jaw. Under this line, about 8 mm. or 5/16 of an inch below the lower margin of the orbit, lies the foramen. The corresponding point on the skin should be carefully marked. The margin of the orbit should be felt with the finger, not only to locate it, but to prevent the possibility of the needle entering the orbit. The needle must enter the infra-orbital canal obliquely so the syringe rests on the wing of the nose and points upward and outward as well as backward, the needle entering the skin well below and inside the point marked. Some patience may be necessary to find the foramen; no force is to be used and the needle must not be delicate enough to endanger its breaking. Only enough novocain is to be used to control the pain until the nerve is found and the patient complains of the peculiar referred pain in the nose, upper lip, and incisor teeth. Then a little more of the solution is to be injected and after waiting ten minutes the alcohol follows. If the needle is certainly in the infra-orbital canal 10 to 15 drops of the alcohol is amply sufficient. If the foramen is not found at the first trial a larger quantity,

2 to 4 c.c. (30 to 60 minims), may be deposited at different points on the surface of the bone around the foramen. This injection is often sufficient even in a very severe neuralgia of the middle branch. In one of my cases where I wished to get the alcohol deep into the canal, so as to reach the branch supplying the socket of the upper canine tooth, which was the seat of greatest pain, the alcohol was felt trickling down the throat, showing that it had passed into the antrum. No harm was done and the complete relief obtained lasted a year. Kiliani, in making an injection into this canal, got an annoying oculomotor paralysis which lasted three weeks. He explains this on the assumption that his needle pierced the periosteum separating the infra-orbital groove from the orbit, and that the alcohol acted on the ocular muscles and end fibers of the oculomotor nerve. Such accidents can be avoided by not inserting the needle more than 5 to 10 mm., 1/5 to 2/5 of an inch, into the canal and injecting the alcohol slowly, stopping if pain should be felt in the orbit.

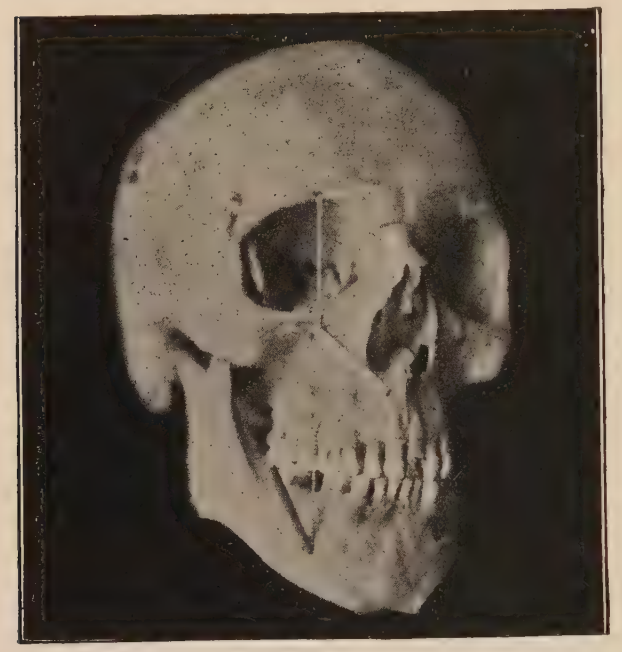

FIG. 1.—THE STRING JOINING THE SUPRA-ORBITAL FORAMEN AND THE MENTAL FORAMEN PASSES DIRECTLY OVER THE INFRA-ORBITAL FORAMEN AND OPPOSITE THE SECOND BICUSPID TOOTH IN EACH JAW. The direction in which the needle must point in order to enter the infra-orbital or mental canal is clearly shown by the match projecting from each.

The Mental Foramen.—This lies opposite the root of the second bicuspid tooth, or the space between the first and second bicuspids. In an adult it is halfway between the alveolar border and the base of the jaw, just below the culdesac formed by the lower lip and the gum. In old people and those whose teeth have been extracted it is nearer the alveolar border and may be directly on it. The needle should be entered from the outside, half an inch behind the second lower bicuspid, pointing obliquely downward and a little inward and forward. The foramen is sometimes difficult to find. Injection here may relieve neuralgia of the third branch, especially if the lower lip is the trigger zone.

Palatine Nerve.—If pain is excited from the roof of the mouth, and the middle branch is not injected in the sphenomaxillary fossa, it may be necessary to inject the palatine nerve where it issues from the posterior palatine canal. This is easily done by following the directions of Lévy and Baudouin:

"The head resting on the occiput, the patient opens the mouth as wide as possible. A half centimeter (1/5 of an inch) inside the inner border of the alveolar arch, opposite the space between the first and second upper molar teeth, the needle is inserted. It (or the syringe) will rest on the lower lip. The region being cocainized, prudent search is made for the orifice of the posterior palatine canal. It is quite large and one will not be long in penetrating it."

The point of the needle should pass obliquely upward and backward so as to reach the hard palate close to the alveolar border opposite the roots of the last molar tooth.

One or more of the injections so far described will often be sufficient to give complete relief even in severe and previously intractable cases, provided all the hypersensitive areas, from which the paroxysms are excited, are rendered analgesic. They alone would constitute a very great improvement on the best treatment of earlier years. Nevertheless, they are not sufficient for all cases, mainly because each division of the fifth nerve has important branches, supplying the eye, nose, teeth, cheek, or tongue, whose fibers, leaving the main trunk in a deep situation, escape the action of superficial injections. If their distribution is only moderately painful they may quiet down after the superficial injections, but if, as sometimes happens, the greatest pain is in the cheek, tongue, or jaws, one or more deep injections will be necessary.

Injections at the Cranial Foramina.—For the deep injections I have adopted the simplified technic of Lévy and Baudouin, as introduced in the United States and described by Patrick.

A Luer or Record needle is used, 5 c.m. long for the third and 6 c.m. for the second branch, so that the hub will be 1 c.m. from the skin when the needle is inserted. The gage is 18 to 20, the point should be shortened and rounded. The essentials are that the needle be strong, blunt enough to push an artery aside rather than pierce it, and of such length that the operator can tell exactly how far the point is from the surface.

The Third Branch at the Foramen Ovale.—The needle is introduced below the zygoma, 2.5 cm. (1 inch) in front of the descending root of the zygoma, which can be felt between the condyle of the jaw and the external auditory meatus. This point should be marked, cleansed with alcohol and ether, and painted with iodin. A little of the novocain solution should be injected into the skin and as deep as a hypodermic

needle will reach. Then the 5-cm. needle is introduced, pointed nearly transversely, but also a little upward and backward, so that at a depth of 4 cm. the point of the needle will strike the base of the skull about 8 mm. back of a transverse line through the point of insertion. Considerable resistance is offered by the masseter and temporal fasciæ, which is to be overcome by moderate continued pressure and a boring motion. If the

FIG. 2.—THE SKULL VIEWED OBLIQUELY FROM BELOW. The third branch of the trigeminus is represented by a black cord emerging from the foramen ovale just back of the external pterygoid plate. The middle meningeal artery is represented by a white cord in the foramen spinosum. The second branch of the trigeminus is represented by a black cord which can just be seen in the upper part of the sphenomaxillary fossa on its way from the foramen rotundum to the infra-orbital groove. The points on the lower border of the zygoma for insertion of the needle are marked by crosses.

direction has been right, when a depth of 4 cm. is reached the point of the needle will lie just below the foramen ovale and the patient will experience a paroxysm of characteristic pain in the lower jaw, lip, and tongue. If blood flows through the needle it is not in the right position and the injection of alcohol should be postponed.

If 15 drops of the novocain solution are now injected the pain promptly ceases, and after waiting fifteen minutes 1 to 1.5 c.c. of alcohol is to be slowly injected, the needle allowed to remain in place a minute or two and then slowly withdrawn. Any oozing of blood is checked by pressure

and the puncture sealed with collodion. If the alcohol is injected before the anesthetic is absorbed there is a burning sensation at the point of the needle and a sudden intense pain is felt along the nerve, both of which cease in a few moments and are replaced by a numb sensation in the distribution of the nerve and some soreness at the seat of injection. The neuralgic pain is gone and the lower lip, cheek, gums, or tongue can be irritated without causing pain.

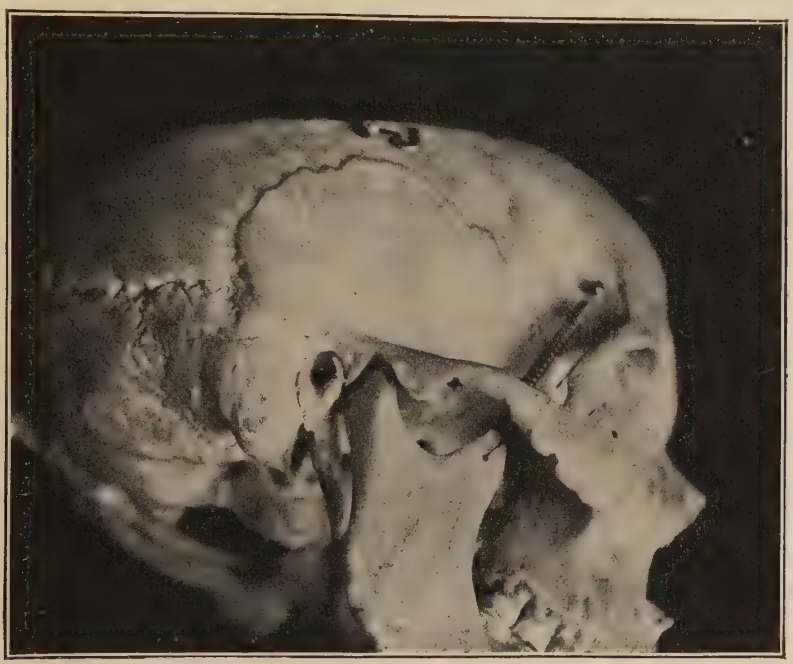

FIG. 3.—SAME AS FIG. 2, EXCEPT THAT THE LOWER JAW IS IN PLACE. The foramen ovale is just seen through the sigmoid notch. The black cord representing the second branch of the trigeminus is seen in front of the coronoid process. The black marks on the zygoma indicate the points for the insertion of the needle. In this skull there is plenty of room to reach the second branch but in some the coronoid process requires the point of insertion to be further downward and forward.

Instead of trusting one's knowledge of anatomy and sense of distance and direction to point the needle directly toward the foramen ovale, one can go more surely, according to the following instruction from Lévy and Baudouin:

"The needle is inserted at the point indicated, but pointed slightly forward and upward. In this way it is always arrested at about 3.5 cm. by the bony surface which forms the cranial origin of the external pterygoid plate. It is necessary to go further back, but this cannot be done without withdrawing the needle some millimeters, in order to free it from

the fibers of the external pterygoid muscle. The point is then slightly inclined backward and again pushed inward. If the same bony wall is again encountered, the maneuver must be repeated. But soon the needle is felt to clear the posterior border of the external pterygoid plate and sink deeper. It is now in the right place, either in line with the foramen ovale or immediately in front of it. This technic requires a strong resistant needle."

FIG. 4.—POINTS OF INSERTION FOR DEEP INJECTION OF THE SECOND AND THIRD BRANCHES OF THE TRIGEMINUS. The straight line back of the eye marks the posterior border of the frontal process of the malar bone and points to the place on the lower border of the zygoma where the needle should enter to reach the second branch. The point of insertion for the third branch is 2.5 cm. (1 inch) in front of the descending root of the zygoma or of the anterior bony wall of the external auditory meatus.

This method has the advantage of surely keeping away from the middle meningeal artery which lies behind and external to the foramen ovale, and also of minimizing the chance of paralyzing the motor root which passes through the posterior part of the foramen. It has the disadvantage of some additional pain unless the local anesthetic is injected as the needle advances.

It is important that the needle should not penetrate too far, not more than 4 cm. in an average adult skull or 4.5 cm. or 3.5 cm. in a very large or very small skull, respectively. Otherwise the eustachian tube might be wounded or the pharynx punctured. In order to be sure of the depth to which the needle should penetrate in any skull, the following method devised by Offerhaus may well be employed: The foramen ovale is in the same sagittal plane as the outer surface of the last upper molar tooth, at its neck, or the corresponding outer surface of the alveolar border of the upper jaw. Therefore, if one measures the transverse distance between the outer surfaces of the last molar teeth or of the extremities of

the alveolar arch and divides by 2, he will have the distance of the foramen ovale from the median plane. Suppose the distance measures 6.5 cm., then the foramen ovale is 3.25 cm. from the median plane. Now measure with calipers the distance from the point below the zygoma where the needle is inserted to the corresponding point on the opposite side. Suppose this is 14 cm., then the point of insertion is 7 cm. from the median plane, and the foramen ovale is 7 minus 3.25, or 3.75 cm. inside the point of insertion. As the needle is not quite perpendicular to a sagittal plane, about 2 mm. may be added, making 3.95 cm. the distance the needle should penetrate.

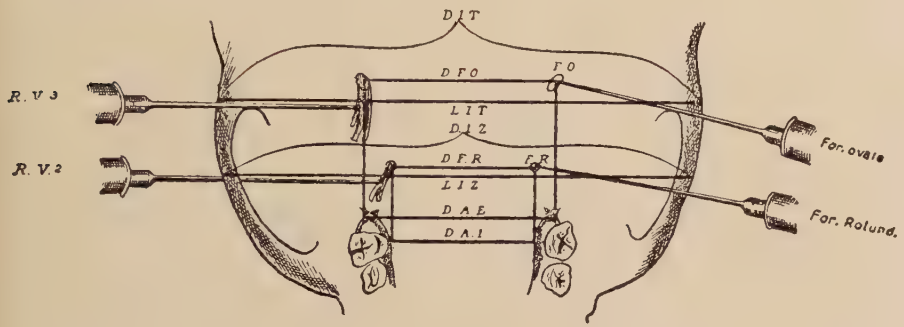

Fig. 5.—Third Branch of the Trigeminal Nerve. D.F.O. = D.A.E. Needle to be inserted to a depth of ½(D.I.T.—D.A.E.). D.I.T. = Distantia intertubercularis. L.I.T. = Linea intertubercularis. D.F.O. = Distantia foram. oval. D.A.E = Distantia interalveolaris externa.

Second Branch of the Trigeminal Nerve. D.F.R. = D.A.I. Needle to be inserted to a depth of ½(D.I.Z.—D.A.I.). D.I.Z. = Distantia interzygomatica. L.I.Z. = Linea interzygomatica. D.F.R. = Distantia foram. rotund. D.A.I. = Distantia interalveolaris interna. (From Offerhaus, after *Jour. A. M. A.*)

Sometimes inequalities at the base of the skull prevent the point of the needle from engaging in the foramen ovale and so make it less likely to penetrate the nerve trunk. In such a case the needle should be introduced some millimeters lower than the edge of the zygoma and so directed that the point will first reach the base of the cranium when near the foramen. This may make it necessary for the patient to open the mouth. It may also be an advantage to start immediately in front of the preglenoid tubercle of the zygoma, perhaps only 1.5 cm. instead of 2.5 cm. from the descending root. The backward slant of the needle should then be avoided or proportionately reduced.

The dangers attending this operation are not great, and yet they must be borne in mind. The instruments, hands of the operator, solutions, and point of insertion of the needle must, of course, be carefully sterilized. The site of injection, though sterile at first, might possibly be secondarily infected from a focus of suppuration elsewhere in the

patient's body. A hematoma might possibly occur in a patient whose arteries and tissues are already in bad condition. Trophic disturbances, even gangrene, *might* occur, but I do not know that they ever have occurred from injection of this branch. The gasserian ganglion has been unintentionally injected, greatly increasing the risk. The middle ear has been filled with alcohol through the eustachian tube and great damage done. In one of my cases a perfectly successful and otherwise uncomplicated injection caused paralysis of the sixth nerve on the same side which cleared up in about two months. How it happened is hard to explain. Another aged patient complained of pain in the *left* eye at the moment the injection was made on the right side and a permanent oculomotor paralysis of the left eye followed, no doubt due to nuclear hemorrhage. A certain amount of ecchymosis is not uncommon, but it does no harm. Paralysis of the motor root of the trigeminus would cause deviation of the jaw to the sound side and confine mastication to that side. The muscles would doubtless recover in a few weeks to six months or more. Accidents of any kind have been few considering the great number of times this injection has been done. Many of them could have been avoided by the exercise of proper skill and care, but even the most experienced operator is not perfectly sure either of hitting the nerve or of escaping all untoward effects.

The Second Branch at the Foramen Rotundum.—The line of the posterior edge of the frontal process of the malar bone, which can always be felt, is prolonged downward, and where it crosses the lower border of the zygoma the needle is to be inserted. In a normal skull this is just in front of the coronoid process of the mandible. The needle is to be inserted transversely, neither forward nor backward, but upward at such an angle that at a depth of 5 cm. its point will be on the same horizontal plane with the lower extremities of the nasal bones and about 3 mm. below the floor of the orbit. It passes through the pterygomaxillary fissure, between the maxilla and the external pterygoid plate, into the sphenomaxillary fossa, and if the inclination is correct it should at a depth of 5 cm. impinge on the superior maxillary branch, where it emerges from the foramen rotundum. Except for the difference in point of insertion, direction, and depth, the process is the same as already described for the third branch. When the nerve is reached characteristic pain is felt in the nose, upper lip, and upper teeth. If there is no bleeding, 1 c.c. of novocain solution should be injected, waiting to see if the eye is disturbed by it. If there is any diplopia on looking to the side of the injection, or any other indication of disturbance within the orbit, the alcohol must not be injected at that point. If the orbit is not disturbed, after waiting fifteen minutes for absorption of the anesthetic, 1 c.c. (15 minims) of alcohol is to be slowly injected, again having the patient look toward the operator so as to detect any paralysis of the sixth nerve.

If the injection is successfully placed the distribution of the nerve will be numb and analgesic.

Offerhaus has devised a rule for finding the depth of the foramen rotundum like that for the foramen ovale. The foramen rotundum is in the same sagittal plane as the inner surface of the last upper molar tooth, at its neck, or the corresponding part of the alveolar border. If, therefore, the distance between the inner surfaces of the last upper molar teeth or the corresponding parts of the alveolar arch is subtracted from the interzygomatic diameter half of this difference will be the transverse distance of the foramen from the point of insertion, to which 3 to 5 mm. should be added on account of the oblique direction of the needle.

There is more danger of accidents and complications in the deep injection of the middle branch than in that of the third. There is the same danger of hematoma if the vessels are diseased and trophic disturbances have been more serious. Schlösser caused herpes gangrenosus in three of his cases. In one senile patient Patrick "caused a free deep hemorrhage," which was followed by necrosis of the hard and soft palate, with loss of a molar tooth. These lesions healed and the pain did not return. Trophic disturbances in the eye, such as ulceration of the cornea, may also be caused. Aside from care in placing the needle, the best way to protect the contents of the orbit is first to inject the anesthetic, as already mentioned, and only when the eye is undisturbed to follow this up with alcohol. Considering the great number of deep injections done, accidents or complications of any kind have been very few, and mostly of a very slight or transient character. In the exceedingly small number of serious complications the patients would probably still choose the operation and all its results rather than to endure the torture of neuralgia.

This injection is often more difficult to make than that into the third branch. The coronoid process of the mandible may come so far forward that the needle must be introduced further forward and lower, thus changing the direction of the needle and increasing the depth necessary. The pterygomaxillary fissure may be very narrow and thus greatly restrict the range of movement within the sphenomaxillary fossa, even making it impossible to reach the foramen.

Ophthalmic Branch.—As this nerve divides while still within the cranium into its nasal, frontal, and lacrimal branches, the deep injection of its trunk is out of the question. The nasal branch cannot be reached without damage to the important motor nerves of the eye. Lévy and Baudouin, "in the rare cases in which injection at the supra-orbital notch does not give good results," have injected the frontal and lacrimal branches by passing the needle along the external wall of the orbit, beginning at the junction of the external orbital process of the frontal bone with the malar. The depth is limited to 3 cm. and no important organ is touched. One naturally shrinks from invading the orbit with alcohol, and for-

tunately severe cases are far less frequent in this than in the other two branches. The supra-orbital and supratrochlear injections are generally so efficient, especially if pain in the middle and third branches is controlled, that deeper injections of this nerve may be dispensed with.

Injection of the Gasserian Ganglion.—The superficial and deep injections of the trigeminus, so far considered, give long periods of relief to the great majority of patients. But the pain always returns and in the severe cases, involving two branches, the intervals of relief may grow shorter, so that the recurrences of dreadful pain and the frequent repetition of injections demoralize the patient. For such cases, to avoid the more formidable gasserian operation, the injection of the ganglion itself has been suggested.

Härtel has devised and elaborately described a method of injecting the ganglion through the foramen ovale, which he has practiced in many cases for local anesthesia in major operations as well as for neuralgia. In all the cases of neuralgia relief was secured lasting to the time of writing, which was too early to warrant a statement as to cure. This method has been practiced and the results confirmed by Loevy, Grinker, and Behan. Alexander and Unger, not believing that Härtel's method insures action limited to the right part of the ganglion, have opened the cranium with local anesthesia, and under guidance of the eye have injected alcohol into several parts of the ganglion, avoiding the ophthalmic portion. The result was good.

There is no doubt that in any case, in which injections into the nerve trunks have given considerable periods of relief, the freedom from pain may be made permanent by successful injection of the ganglion. The dangers of the operation, however, are very serious. Incomplete destruction of the ganglion may make trophic disturbance of the eye especially severe and even leave the pain worse than ever. If the alcohol gets into the cerebrospinal fluid it may cause an aseptic meningitis with serious or fatal damage to other cranial nerves. If nothing better could be done these risks might be justified, but section of the sensory root of the ganglion is more certainly efficient and far safer. Therefore, instead of attempting to inject the ganglion, the patient should be sent to a neurological surgeon.

Avulsion of the Sensory Root.—The first gasserian operations consisted in cutting the second and third branches at their entrance into their foramina and tearing out the corresponding two-thirds of the ganglion, leaving the ophthalmic portion attached to the wall of the cavernous sinus. It was a difficult, dangerous operation, with a very high mortality and great danger of serious complications, especially in the eye, but it generally, not always, put an end to neuralgia for the survivors.

Abbe sought to attain the same result by cutting the second and third

branches and inserting a piece of rubber tissue between the ganglion and the foramina. Van Gehuchten, on the ground that regeneration on the central side of a spinal root ganglion or its homologue, the gasserian ganglion, is impossible, suggested the mere section of the sensory root, allowing the ganglion and its peripheral connections to remain undisturbed. This has been done by Horsley and by Frazier with Spiller's advice. Cushing, after a large and highly successful experience with complete removal of the ganglion, has adopted avulsion of the sensory root as the best operation. Adson, of the Mayo Clinic, has performed it in a great number of cases with most satisfactory results.

As now performed by the specialists in neurological surgery this operation is one of the safest, the mortality, in hundreds of consecutive cases, being less than 1 per cent. The eye, if properly shielded from irritation and cleansed with boric acid solution, is seldom seriously impaired; occasionally there will be a trophic ulcer of the cornea. The third and sixth nerves and the motor root of the fifth can be distinguished from the sensory root and left unimpaired. No deformity of face or cranium is left, not even a conspicuous scar. In all typical neuralgias that have previously been relieved by injections of alcohol the cure on the affected side is complete and permanent. The most troublesome after effect is a continuous feeling of numbness and stiffness, which the patient should be prepared to accept. Very rarely neuralgia may appear later on the opposite side, in which case the treatment should be limited to injections of alcohol.

Incurable Cases.—In a very small percentage of cases regarded as neuralgia, injections of alcohol completely fail to give relief, and if the ganglion is destroyed or the root avulsed nothing is gained. These cases are atypical in their symptoms, the pain generally being less paroxysmal, less influenced by peripheral excitations and more nearly continuous. Cushing has recorded a number of them. If we assume the unknown lesion of true neuralgia to be in the ganglion we must in these cases regard it as more central, probably in the thalamus or cortex. When the failure of injections is apparent one should conclude that the major operation would also be useless and, making the best of a deplorable condition, give such relief with drugs as may still be possible.

Summary of the Treatment of Trigeminal Neuralgia

1. An attempt to remove all local and constitutional causes, together with incidental relief of pain as far as may be necessary and possible. If no definite, constitutional cause is found, salicylates should be tried.

2. Soothing local measures, warmth and protection from irritation. As long as there is a fair prospect of success these measures should be persevered in without depriving a nerve of its sensibility, for the pain has

some value as indicating a constitutional or local cause to be removed and the normal function of the nerve should not needlessly be sacrificed.

3. Analgesics and narcotics.
4. Alcohol injections in the foramina of the face.
5. Deep alcohol injections.
6. Avulsion of the sensory gasserian root.

Cervico-occipital Neuralgia

Acute neuralgia of the occiput and neck is generally caused by exposure to cold and wet plus a probable subinfection, and yields readily to general and local warmth, free elimination, and a salicylate. Phenacetin or a mild opiate, such as codein or Dover's powder, may be advisable.

Chronic pain in this region should cause a most careful search for organic disease of the bones or spinal membranes. Idiopathic chronic neuralgia is very rare. When it exists the general treatment of trigeminal neuralgia is applicable. Salicylate of sodium and potassium iodid should be given a thorough trial. Galvanism, a large anode on the occiput, with strong currents, if necessary, is especially recommended by Remak. The great occipital nerve can be injected with alcohol where it emerges from its opening in the trapezius and crosses the superior curved line of the occipital bone, 2 cm. from the median line. Painful points along the course of the nerves may also be injected immediately beneath the skin.

Brachial Neuralgia

Before treating brachial pain as a neuralgia, the possibility of its being a symptom of organic disease of the spine, membranes, cord, or nerve trunks must be carefully considered. If such organic disease is found, the treatment is to be that described under neuritis. Constitutional causes must also be looked for, and, if found, treated, especially rheumatism, gout, diabetes, and anemic or cachectic conditions. Inflammation of the joint or bursal sacs about the shoulder may simulate neuralgia, and yet require altogether different treatment. Oppenheim says:

"Taking all in all, I regard a true, pure brachial neuralgia as a rare affection; there is usually a background of hysteria or neurasthenia, of an organic disease, or a constitutional illness (diabetes, etc.). I have found more and more that brachial neuralgia is, as a rule, a brachial psychalgia."

It is of the utmost importance to recognize the psychic element in such cases, for the right treatment is that of hysteria or psychasthenia, and any other is sure to be unsuccessful. For the neuralgic element

proper constitutional treatment is most important. Locally rest, warmth, galvanism, judicious massage, and counterirritation are of use. The nerves should not be injected or stretched as long as there is any possibility of the arm being useful. The so-called amputation neuralgias are caused by neurona. The bulbous nerve end should be resected, the nerve sheath closed by suture and absolute alcohol injected to prevent the otherwise inevitable reformation of the neuroma (Huber).

Intercostal Neuralgia

The pains symptomatic of organic disease of the spine, membranes, or cord are not considered here, nor are the referred pains of visceral disease as described by Head. Herpes zoster is treated separately.

The causal and constitutional treatment appropriate to neuralgia in general is indicated here. Gout, syphilis, and states of exhaustion are especially likely to call for treatment. A neurotic factor is often present, requiring psychic treatment. Light blistering over the painful points may help. Local warmth and restriction of the movement of the ribs by a bandage are often serviceable. Stretching of the nerves and resection of ribs have been done, not always with success. It would be better to inject alcohol subcutaneously over the painful points or as close to the nerve trunk as possible.

Lumbo-abdominal and Crural Neuralgia

Pains in the distribution of the lumbar plexus may at first seem to be true neuralgia. Careful examination, however, will almost invariably show that they are symptomatic of disease of the spine or pelvis or of neuritis. In such a case the treatment must be that of the cause, with incidental relief of pain. In the few cases that may be regarded as idiopathic the treatment applicable to neuralgia in general, with local rest, protection, and warmth, is indicated.

Pudendohemorrhoidal Neuralgia

If the paroxysms of pain are in the spermatic cord and testicle a suspensory bandage should be worn and antineuralgic and narcotic drugs used sparingly. A neurotic mental condition is generally present and calls for psychic rather than local treatment. Resection of the testicular nerve has been done by Chipault with success.

Pains in the anus, perineum, and rectum, when not due to organic nervous disease, such as tabes, or to inflammation of the pelvic organs, are generally of an hysterical or neurasthenic nature. Careful search should be made for a local cause, such as hemorrhoids, anal fissure, or urethritis,

in order to remove it if possible. If none is found, the pain may be cautiously antagonized by suppositories of opium or cocain, but the general mental and nervous state should receive the chief attention, the treatment being that of hysteria or psychasthenia. Local treatment of any kind, if not really necessary, is often harmful, because it keeps the patient's mind on his pains. A single thorough examination followed by assurance that the local conditions are all right, with concentration of attention on some other condition which can be favorably modified, is often the best treatment.

Coccygodynia

Pain of a neuralgic character referred to the coccyx may be due to local injury, as from parturition or a fall, or to inflammation of the surrounding tissues. A careful examination should be made and any local disease should be treated conservatively on surgical principles. All the cases I have seen have been of an hysterical character, in which treatment of the general nervous and emotional condition was of prime importance, and the less said or thought about the coccyx the better. Excision of the coccyx has generally been a useless and harmful operation performed on a mistaken diagnosis. Unless there is unmistakable visible deformity or gross disease, operation is far more likely to aggravate the complaints than to cure.

Herpes Zoster

It is now safe to regard the peculiar eruption of herpes zoster as being in every case the trophic expression of inflammation of the corresponding ganglion of the posterior root, whether spinal or cranial. The older observations of zoster, apparently due to inflammation of the nerve trunks, nerve roots, or posterior columns of the cord without lesion of the root ganglion, were probably wrong because of defective methods of studying the ganglion. In the most typical cases the disease appears to be an idiopathic inflammation of one or more of the root ganglia, analogous to poliomyelitis, due to an unknown specific germ. This form of the disease runs a short course, reaching its height in a few days, and then rapidly subsiding, although some of its bad effects may persist. One attack of this kind confers immunity. Purely toxic conditions may also cause herpes zoster, especially arsenical poisoning. Gout is a possible toxic cause. In addition to the idiopathic and toxic cases, there are symptomatic ones in which the inflammation of the root ganglion is secondary to adjacent organic disease, as in Pott's disease or any of the forms of spinal meningitis.

Treatment as to Cause.—If any primary organic, infective or toxic disease can be discovered, its importance will overshadow that of the complicating zoster, and its treatment will be the first consideration. If the

case is idiopathic there is no way at present of influencing its course. Naturally one would keep the patient at rest, open the bowels, and administer salicylate of sodium, salophen, or aspirin. In addition to this, as hexamethylenamin is known to exert some antiseptic effect on the cerebrospinal contents, it would be wise to administer it if the patient is seen early, gm. 0.5 (7½ gr.) three or four times daily for an adult.

Local Treatment.—This consists essentially in protecting the vesicles from irritation and infection. Starch or talcum powder with an addition of 10 per cent of the finest powdered boric acid should be applied freely to the affected skin and a binder of fine muslin or linen be smoothly and firmly applied, so as to prevent any friction from the clothing. From 1 to 3 per cent of powdered camphor may be added to allay burning and itching. If the pain is severe, instead of the powder a 1 per cent ointment of cocain, eucain, or stovain in lanolin and vaselin may be spread on the cloth and applied. A 50 per cent solution or ointment of ichthyol acts well.[1] The vesicles should not be opened unless they are so tense as to increase the pain, when they may be incised at the summit. All irritating substances should be scrupulously avoided, for the skin lesions may increase both in extent and in severity after a local application of any character, and then the patient is very likely to think that a great mistake has been made, unless he knows that the dressing is of a mild and soothing character.

Late Pain.—After an attack of herpes zoster, it sometimes happens, especially in the debilitated or aged, that the pain persists for weeks or even for an indefinite time. This is probably due to cicatricial changes in the root ganglia. Measures to build up the general health and promote absorption are indicated. Strychnia, iron, and potassium iodid or the iodid of iron are valuable. I see no reason to expect any good from the preparations of phosphorus in such cases. Cod-liver oil may be very useful where it can be digested; if it is not well borne, butter and cream are good substitutes. Small blisters over the affected spinal ganglia may help, and light touches with the Paquelin cautery are still more effectual. Analgesics and narcotics are to be used as in neuritis and neuralgia. The periphery must be protected from irritation of all kinds, mechanical, thermal, and chemical. If the nerve trunk has no important motor functions and other means fail, alcohol injection should be tried. It will not be as effectual as in true neuralgia, because there is organic disease central to the injection, but cutting off impressions from the periphery may do good by giving the inflamed ganglion rest. The epidural injections of Cathelin have a special value in such cases, as the solution can come into close relation with the root ganglia unless they are situated too high. Gowers

[1] I have had good results by strapping with zinc oxid rubber adhesive plaster when this can be done. But it is necessary to employ a well-made and pure oxid of zinc plaster. Even then some patients are found whose skin does not tolerate it.—Editor.

quotes Sir William Jenner as telling of a patient who, in the days before anesthesia, endured the excision of the skin area affected by zoster, and then, finding he was not relieved, killed himself. Even in a less extreme case than this, other means of relief failing, section of the posterior roots should be tried, although the ultimate value of this operation is still unsettled.[2]

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[2] An attack may be much shortened and the pain immediately diminished or entirely relieved by quickly applying to the areas of eruption a 95 per cent solution of carbolic acid with a camel's hair pencil. Immediately wash off the same region of skin with 95 per cent alcohol. Let the surface dry and apply a sterile dry dressing over a light powdering of the surface with boric acid. The result is remarkable in the relief of suffering which it affords.—Billings.

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DISEASES OF THE BRAIN

CHAPTER XII

DISEASES OF THE BRAIN COVERINGS

JULIUS GRINKER

Introduction.—In the treatment of diseases of the nervous system, as perhaps in no other class of human ailments, a correct diagnosis must precede all efforts at definite relief. I have, therefore, introduced each chapter with a brief discussion on pathology, etiology, and diagnosis. My principal aim has been to impress the reader with the importance of taking a broad outlook on the disease and its management, rather than to burden his memory with minute descriptions of the numerous methods of treatment detailed in the literature of the day. In conformity with this thought I have put the greater emphasis not on the latest, but the most useful means of combating the ravages of organic disease of the nervous sys

DISEASES OF THE DURA MATER

PACHYMENINGITIS EXTERNA

Inflammation of the external layer of the dura is usually caused by extension of disease from the cranial bones. Forming the periosteum of the skull, the dura may become infected by mere continuity from fracture of other trauma. By contiguity osteomyelitis, caries, syphilis, erysipelas, or neoplasm of the skull may give rise to dural inflammation.

The *treatment* is purely surgical and identical with that of the underlying conditions.

PACHYMENINGITIS INTERNA HÆMORRHAGICA

Of greater importance from a therapeutic point of view is the variety of inflammation involving the inner layer of the dura. It is necessary to review briefly some points in pathology, etiology, and diagnosis.

The essential *pathology* in pachymeningitis interna hæmorrhagica is found on the inner surface of the dura in the form of membranous de-

posits, in which are imbedded fragile blood-vessels with a tendency to repeated hemorrhages. By an increase of fibrinous deposits a mass of variable size may form which resembles a blood tumor, both in appearance and its symptomatology. It is not quite settled whether fibrinous formation precedes hemorrhage or whether the latter is the cause of the former by the formation of organized clots adhering to the dura. Whichever view is correct, the localization of this process takes place with special preference over the parietal and frontal areas in the neighborhood of the longitudinal sinus.

The disease selects individuals past fifty years of age, and especially those who have become weakened by alcohol, syphilis, cachexias of various kinds, or are the subjects of general paresis or other chronic brain disease of the atrophic type. Sufferers from blood diseases, such as pernicious anemia, scurvy, hemophilia, purpura hæmorrhagica, etc., are also prone to develop this condition. In the majority of instances, in addition to the several predisposing causes mentioned, trauma plays the most prominent rôle in the production of symptoms.

Symptoms.—No distinction is made between symptoms arising from hemorrhage and those caused by inflammation. As a rule, the general signs predominate over the focal ones. Depending upon the frequency and amount of hemorrhage, the symptoms will be either mild or severe, with or without remissions of varying duration. In this respect meningeal hemorrhages differ from those occurring as spontaneous intracranial bleedings, in which latter a single large mass of blood is usually thrown into the brain, plowing it up and causing symptoms in one hemisphere, hemiplegic or monoplegic in kind. In pachymeningitis interna hæmorrhagica, however, symptoms are more apt to be bilateral in distribution.

The symptom of greatest importance, because most frequently present, is *headache*. The head pain is not always intense, varies in duration, and is often accompanied by vertigo and a tendency to nausea and vomiting. There are usually general weakness, mental and physical lassitude, and absence of initiative. Of the somatic signs a frequent complaint is the inability to tolerate light and noise—so-called hyperesthesia of the special senses. Insomnia is common. There are, besides, changes in the size of the pupils—they may be small, large, or unequal. Nystagmoid jerkings in the eyeballs and spasmodic twitchings in the muscles of the face or of the extremities are not uncommon. Toward the end there appears somnolence of varying degree; distinct motor paralysis with fever and convulsions may close the scene.

The *prognosis* is exceedingly grave. The tendency is for repeated hemorrhages to occur at short or long intervals, sooner or later leading to a fatal termination.

Prophylaxis.—Dural inflammation being always secondary to other disease processes, prophylaxis must confine itself to the treatment of the

underlying condition. If the cause be syphilis, a rigid course of antispecific treatment should be instituted. In nephritic and cardiac conditions the heart and kidneys must be treated.

The patient's life must be so regulated as to avoid worry and physical and mental stress. The diet should be nutritious and non-stimulating.

Treatment.—To combat the disease itself our efforts are directed toward the prevention of congestion and fluxes to the brain. We endeavor to stop the hemorrhages by the use of ice and cold applications to the head. In robust individuals leeches or wet cups may be placed near the region of the longitudinal sinus, or over the mastoid processes. To reduce congestion we administer laxatives and drastic cathartics, thereby attempting deflection of the blood current from brain to intestines.[1]

Symptomatic Treatment.—For the headache ice to the head and local depletion are indicated. Occasionally the administration of any of the coal-tar derivatives, such as antipyrin, 15 gr. (1 gm.); phenacetin, 10 gr. (0.6 gm.); aspirin, 10 gr. (0.6 gm.), gives prompt relief to the patient. When everything else has failed, and only then, is the hypodermic use of morphin justified. In weak heart with fluttering pulse cardiac stimulants are in order.

Surgical Treatment.—When localizing symptoms, such as one-sided epileptic convulsions, unilateral paralysis, hemianesthesia, hemianopia, or aphasia, enable one to diagnose the seat of difficulty, an exploratory craniotomy should be made at once.

If successful in finding the nidus of trouble, clots should be carefully removed, bleeding points checked, and the osteoplastic flap replaced. In at least one case has such a procedure saved my patient.

A measure advocated by Oppenheim is the combination of bleeding with sweatings. In skilled hands Neisser's brain puncture may not only enable a localizing diagnosis to be made, but may also effect a cure by the removal of large quantities of blood.

Traumatic Hematoma

In this connection may be discussed the hemorrhages about the dura which are the result of trauma. These hemorrhages may occur between skull and dura, called extradural, or between the dura and arachnoid membrane, subdural. The extradural hemorrhages are derived from the middle meningeal artery or its branches, and are commonly caused by fracture of the skull. Of all traumatic intracranial hemorrhages those from the meningeal arteries are the most frequent.

The hemorrhages on the inner surface of the dura are derived from torn veins about to empty into the various sinuses, or they may come

[1] Drastic catharsis also lowers the blood-pressure by removing fluid from the circulation.—Editor.

from the sinuses themselves. In this class belong the meningeal hemorrhages of the newborn, which so frequently terminate in permanent paralysis, idiocy, or epilepsy. As these conditions receive mention in another place, they will not be further discussed at this time. In order to produce a blood tumor, the violence applied to the head need not be excessive. In fact, the skull has often been found uninjured, while extensive bleeding was going on within. In both the extradural and the subdural varieties of traumatic hemorrhage the brain substance is not necessarily damaged, as it is, for instance, in subarachnoid bleeding. Regarding the location, both dural and subdural hemorrhages take place on the side of the injury, but the opposite side may become implicated by "contre-coup." The amount of blood poured out in each case will largely depend upon the size of the vessel involved. The hemorrhage may become circumscribed and appear in the form of a so-called hematoma, or it may spread diffusely over a large area—in some instances covering almost an entire hemisphere.

Symptoms.—Immediately upon the receipt of an injury, such as a blow upon the head, the patient may suffer from concussion of the brain with its concomitant shock, but soon consciousness is regained. However, as the bleeding proceeds, the patient gradually becomes stuporous and even comatose, unless hemorrhage can be arrested. The interval of time between trauma and the development of symptoms varies from several hours to even weeks. The rule is for a patient to become delirious or somnolent within a few hours. Stupor may then deepen into coma, with slow respiration, retarded pulse, and stertorous breathing—all characteristic signs of cerebral hemorrhage and brain pressure. According to Pagenstecher, the mass of blood must have obtained a circumference of between 37 and 42 cm. before symptoms of pressure can become manifest. Prior to the development of coma, optic neuritis may be observed on the side of the trauma; also unilateral or bilateral convulsions. On the side opposite to the injury there may appear tonic spasm, opisthotonos, Kernig's sign, and later motor paralysis. As previously intimated, the hemiplegia or monoplegia may be on the same side as the trauma, provided the opposite side of the brain sustained the brunt of the attack by virtue of "contre-coup." Aphasia will indicate that the damage has affected the centers of speech, which are situated on the left side. Hemianesthesia and hemianopia, if present, will also guide one to a proper localization of the hemorrhage.

In the absence of any focal symptoms it is important to study an existing slight asymmetry of the face, twitchings of muscles, unilateral exaggeration of knee and Achilles reflexes, and to examine for Babinski, Oppenheim, and Gordon signs. The character of the coma may occasionally assist in diagnosis: it is seldom profound and often only transient. A peculiar dazed state following coma is, according to Kocher, quite signifi-

cant for this condition. If the hemorrhage is at or near the base of the brain, cranial nerve palsies may direct attention to its location. In any hemorrhage of considerable size patients die, unless energetically treated, and even then they cannot always be saved. In slight hemorrhage general symptoms subside and the focal signs resulting from organized clots take their place. Perhaps only then may we discover the lighter grades of hemiplegia, hemianesthesia, and unilateral epilepsy—all of which may become more or less permanent. In some cases the symptoms are so ill defined from the beginning that the condition is not diagnosed until vertigo, headache, weakness, poor memory, and lack of mental concentration become evident, and direct our attention to what had at first appeared as an insignificant trauma.

Diagnosis.—Hemorrhage is occasionally confounded with concussion and contusion of the brain. It is important to remember that in the latter states symptoms develop almost immediately, while in meningeal hemorrhage there is usually a latent interval.

Lumbar puncture may help in the differential diagnosis; if the fluid is yellowish or reddish, it demonstrates the probable existence of hemorrhage. Other tests will corroborate this finding. Even in excessive bleeding the spinal fluid may not differ from the normal. Oppenheim advises cerebral puncture after the method of Neisser-Pollack, not only for diagnosis, but also for treatment.

Treatment.—When a hemorrhage from the middle meningeal artery has been diagnosed, the only course open to the physician is to trephine, clear out the clots, look for and ligate the bleeding artery. Before resorting to this radical procedure it is absolutely necessary to have made a focal diagnosis. Timely operation has saved many lives. That noninterference is almost certain to cause a fatal termination has been properly emphasized by W. W. Keen. Wiesmann states that, of 147 cases treated expectantly, 131 died—89.1 per cent; of 110 cases treated actively, only 36 died—32.7 per cent. In the majority of his fatal cases the clot was not removed because it could not be reached.

Concerning the side of the skull which should be operated on, we must be guided entirely by localizing signs rather than by the site of the injury. Krönlein trephined 4 cases of rupture of the middle meningeal, and in 2 of these he removed the clot, and the patients recovered. In other cases he failed to find it, and those patients died. According to Krönlein, quoted by Keen, in by far the greatest number of cases the clot can be best reached by trephining at a point 1 inch behind the external angular process of the frontal bone, at the level of the upper border of the orbit. Should this not reach the clot, then a second trephine opening should be made just below the parietal bone at the same level as the former. By not making this last opening he lost the 2 patients alluded to. By the anterior opening access is had to the main trunk of

the anterior branch of the middle meningeal artery; by the posterior, to the posterior branch. In many cases there will be doubt as to which branch is involved; the two openings will, therefore, lead to the desired goal under all circumstances. Having made one or both of these openings, the clots are removed, and either opening may then, if necessary, be enlarged with rongeur forceps, in order to gain access. If the pupils be widely dilated, showing that the clot has extended toward the face, the trephine should be applied about half an inch below the level of the upper border of the orbit rather than at its level.

If no localization signs are present, and the symptoms of hemorrhage proceed, then the life of the patient is in danger, and it will be best to trephine over the place of injury. Several authors, recording cures of meningeal hemorrhage by repeated lumbar punctures, are consequently strong advocates of their use. Dévrain praises this procedure in birth palsies when the fetus is apparently dead. Harvey Cushing, in subdural hemorrhages resulting from prolonged labor, opens the skull and clears out the clots. He maintains that the operation should be done immediately after birth; delay is either fatal to life or else causes irreparable damage to the brain structures, commonly seen as birth palsies of hemiplegic or monoplegic distribution, with or without epilepsy. These views on the surgical treatment are largely taken from Keen, whose opinions have found general acceptance.

ACUTE INFLAMMATION OF THE SOFT CEREBRAL MEMBRANES

Introduction.—The leptomeninges may be considered a closed lymph sac, of which the inner layer dips down into all the fissures, becoming intimately connected with the brain substance. From this layer originate the capillary vessels which nourish the brain. Between this and the outer layer we find the so-called subarachnoid fluid. The pia may be considered a serous membrane in the same sense as the peritoneum. Just as infections reach the peritoneum from the viscera to which it is reflected, so do infectious processes spread into the cranium from adjoining territory—the several sinuses, orbit, ear, mouth, antrum of Highmore, etc. Inflammation of the soft membranes is always the result of an infection which has gained access to the arachnoid space, that is, between the two layers of the leptomeninges. The cerebral membranes being continuous with the coverings of the cord and the lining of the ventricular system, we may have an extension of disease from these sources. As there exist no anatomical limitations to the spread of the inflammation, it may become more or less diffuse. This is well exemplified in the variety called epidemic cerebrospinal meningitis, in which the membranes of the brain and spinal cord are involved. The inflammation is not always diffuse. In some

cases the convexity suffers most, while in others, as, for instance, the tuberculous variety, the base of the brain is principally affected. In the last location conditions are particularly favorable for the development of inflammation, the large cisterns with their slow lymph currents offering exceptional opportunities for microbes to flourish and to multiply.

By means of a spinal puncture it is possible to diagnose the kind of microbe causing meningitis. In this place mere enumeration of them must suffice. There are:

1. Frenkel's pneumococcus.
2. Diplococcus intracellularis meningitidis (Weichselbaum).
3. Streptococcus.
4. Staphylococcus.
5. Typhoid and paratyphoid bacillus.
6. Colon bacillus.
7. Influenza bacillus.

Cerebral meningitis rarely or never occurs as an independent affection. Nearly all cases originate from an infectious depot outside the cranial cavity. We recognize two paths by which the cerebral membranes may become infected: first, by the blood current, this being the common carrier for the various acute infectious diseases; second, by the lymph current. Through the last route microbes arrive from the contiguous accessory cavities, as the sinuses, the nasopharynx, and the orbit. In like manner inflammations from the cervical membranes spread to the cerebral meninges.

Acute (Purulent) Cerebral Meningitis or Leptomeningitis

Symptoms.—This type is usually ushered in with the phenomena of an acute infectious disease, unless masked by the symptoms of another disease of which this is a complication. A typical case commonly begins with chills and fever, severe headache, and cerebral vomiting. Clouding of consciousness soon follows, and in fulminant cases coma may close the scene.

For convenience of description the symptoms are divided into those of *irritation* and those of *paralysis,* although there exists no sharp line of demarcation between them, for irritative often insensibly merge into paralytic phenomena. To the signs of irritation belong the intense headache, insomnia, general hyperesthesia, as well as the hypersensitiveness of the special senses, such as intolerance to light and sound. Other of the irritative symptoms are: nystagmus, twitchings in the muscles of the face and of the extremities, contracted or unequal pupils, spasticity of the muscles of the neck and of the abdomen (boat-shaped abdomen), and rigidity of the back muscles causing arching (opisthotonos). The legs

are spastically flexed, and in some cases there may be general convulsions. Kernig's sign is a prominent and characteristic symptom, though not pathognomonic of cerebral meningitis, as was formerly thought.

Toward the end of the disease appear the symptoms of paresis and paralysis. Of the mental functions the psychic reactions are early disordered; increased irritability is present. Somewhat later there is lack of responsiveness—the sensorium becomes clouded up to loss of consciousness. Of motor paralysis we have strabismus, either temporary or permanent. The pupillary narrowing gives way to dilatation, with loss of reaction to light and accommodation. Spasticity in the extremities is replaced by flaccid paralysis, terminating in hemiplegia or monoplegia. In the somatic sphere we may encounter the following symptoms: vomiting, constipation, retention or incontinence of urine. The pulse is relatively retarded early because of vagus irritation, but toward the end it becomes rapid, owing to the paralysis of the vagus nerve.

Diagnosis.—It is not always easy to differentiate the various types of meningitis. For that reason Quincke's lumbar puncture has a diagnostic value of great importance. It will not, therefore, be out of place to describe the technic. Though Quincke originally recommended his lumbar puncture for therapeutic purposes, this method has recently come to be utilized more often in diagnosis. It consists essentially in obtaining a small amount of cerebrospinal fluid by means of a puncture through the spinal membranes, and subjecting the same to a chemical, microscopical, and bacteriological examination.

The technic is as follows: The puncture should be made between the third and fourth lumbar vertebræ in the median line in children, and about one-half inch to one side in adults. This point may be determined by drawing a line from the highest point of the crests of the ilia, which will cross the fourth lumbar interspace. Another aid is the fact that the spinous process of the fifth lumbar vertebra is more prominent than the spinous processes of the sacrum. The patient should preferably be placed on the left side with the thighs flexed upon the abdomen and the head bent forward as far as possible. The point to be punctured should then be marked and the back sterilized in the usual way. The needle, previously sterilized, should be grasped in the right hand, the point placed over the mark on the skin, and held at an angle of 45° with the surface of the back inclined slightly toward the median line. It should then be pressed forward slowly and steadily. When it has been introduced from 2½ to 3½ inches, it may be assumed that it has entered the canal, and the mandril may be withdrawn. When the fluid begins to flow the manometer should be attached and the pressure measured. The fluid is then allowed to flow into a glass tube until it begins to drop slowly, when the needle is withdrawn and the puncture sealed with flexible collodion. If the needle strikes bone it should be withdrawn and reintroduced in a

different direction. Should it become clogged, the trocar may be reintroduced to clear it. If the patient becomes dizzy and complains of headache, the operation should be discontinued.

As a rule, no anesthetic is required, but an ethyl chlorid spray may advantageously be used. It is understood that this little operation must be done under perfect asepsis. For diagnostic purposes a small amount of fluid is sufficient, about 5 c.c.

The normal pressure is, according to Quincke, 40 to 60 mm. of water, though he only considers an increase to over 150 mm. to be pathologic. Under pathologic conditions the pressure may increase to 700 mm. Roughly, we estimate the pressure by the rapidity of the flow, so that, if in a short time 30 to 40 c.c. of liquid escapes, we conclude that there is a pathologic increase. The increase of quantity and pressure occurs under various conditions, especially in cerebral tumor, all varieties of meningitis, chlorosis, and edema of the brain.

From the physical appearance of the fluid alone we can often make a correct diagnosis. The fluid is clouded in the purulent and epidemic varieties of meningitis. It may be turbid in tuberculous meningitis, but this is especially characteristic of the different forms of purulent meningitis. If no pus appears to be present, the polynuclear leukocytes will sometimes reveal the purulent condition. In tuberculous meningitis the lymphocytes predominate, while there may be only a few leukocytes present.

The bacteriologic examination is extremely important. In purulent meningitis we find streptococci and staphylococci; in epidemic cerebrospinal meningitis, the Diplococcus intracellularis meningitidis of Weichselbaum; in tuberculous meningitis, tubercle bacilli. The last are usually found in the flocculi; if not present in these, the centrifuge may reveal them. If the fluid appears sterile, as it often does, a culture may give positive results, or the fluid injected into a rabbit or guinea pig may develop typical tubercles. It will be observed that the careful examination of the spinal fluid may decide an otherwise doubtful diagnosis, although in the majority of instances a lumbar puncture is only confirmatory of the diagnosis.

Lumbar puncture has been tried as a therapeutic measure in most diseases of the brain and cord; it is of great value in relieving pressure when there is an excess of cerebrospinal fluid, and also in removing with the fluid the toxic agents causing the disease. It is, therefore, exceedingly useful in all forms of meningitis, and has been of great service in uremia.

Physicians must be warned that lumbar puncture is not a procedure to be used indiscriminately, as a number of deaths have resulted from it in ill-chosen cases. It is contra-indicated when arteriosclerosis exists, and in all diseases of the nervous system in which there are not

present symptoms of pressure. For diagnostic purposes it should be used only when the diagnosis is really in doubt.

Prognosis.—The prospects for recovery in diffuse acute cerebral meningitis are not good. The majority of cases die after a period of days or weeks. We hear of occasional complete recoveries, but most of these are of doubtful authenticity. Possibly some of these were cases of serous meningitis or of meningeal irritation, so-called meningismus. When acute cerebral meningitis passes on toward recovery, the acute usually changes into a subacute course and the symptoms lose their virulence. Patients recover with intellectual deficit, amounting to idiocy. Deafness from changes in the inner ear is common. Blindness resulting from optic atrophy is one of the sequelæ of leptomeningitis. In the cases of meningitis following other diseases, a suppurating ear, or trauma, such as skull fracture, the mortality is high. The prognosis will depend upon whether surgical intervention is undertaken early or late. Localized forms of meningitis of the purulent variety may recover when the pus depots are thoroughly evacuated.

Prophylaxis.—In a disease with so few recoveries prophylactic treatment occupies a prominent rôle. It will be our duty to treat promptly all local suppurating foci near the head, in order to prevent the spread of an infection to the meninges. In all those instances in which a primary disease center is discovered, be it near or far, our duty is to attempt instantaneous clearing out of the same, regardless of its situation. If the starting point of meningitis is in the ear, eye, or intra-orbital tissues, these will require a thorough search for suppurating depots. The nose in particular constitutes a prolific source of infection. In every suspicious case of meningitis, therefore, the nose will have to be hunted down, because its lymph vessels have a direct connection with those of the meninges. Its mucous membrane can be treated advantageously in the beginning of every case. Likewise must the frontal and maxillary sinuses receive surgical care. The pharynx being another source of infection, it has to be treated energetically. Any existing tonsillar or pharyngeal inflammation will, of course, receive immediate consideration. For reasons that are evident, abscesses, carbuncles, and other septic foci in the upper portions of the neck may cause meningitis. Erysipelas of the face and head occasionally causes meningitis by disseminating the septic products through the veins and lymph vessels of the scalp. As a matter of course, the underlying conditions will have to be dealt with in no uncertain manner. Even insignificant traumata about the head should be given immediate surgical attention, for from such sources meningitis may develop days and weeks after the trauma had been forgotten and the patient had considered himself well. Caries of the skull bones, osteitis, and intracranial neoplasm, the infectious granulomata, such as gumma and tubercle, may all produce some form of leptomeningitis. The indications for action are

clear; extirpate the tumor masses and remove any existing pus from all extracranial and intracranial avenues.

Summary.—Whenever there is a sign of beginning cerebral meningitis, the rule is to make a careful local examination of all the cavities and sinuses about the head, then to search out the pus depots, and finally to open widely and drain freely.

Treatment—*Specific Remedies.*—There are no specific remedies for this disease. The claims made by some that mercurials rubbed into the scalp have saved lives rest entirely upon self-deception. Nor can Credé's ointment be credited with cures, though its application was recommended in a previous revision of this work.

Laboratory workers are straining their efforts toward the preparation of specific sera and vaccines for the various types of meningitis. However, with the exception of Flexner's serum for the epidemic variety, the serum treatment for meningitis is something for the future. The logical conclusion is that prophylaxis is for the present, at least, the most important specific.

Symptomatic Treatment.—In the initial stage the fever should be controlled by bathing. As in other conditions we are occasionally obliged to make use of the salicylates, also of antipyrin, acetanilid, and phenacetin. Intense headache may be relieved by applications of cold to the head, the administration of bromids, withdrawal of blood by means of leeches applied to the mastoid processes, the temples, angles of the orbit, and the nose. To most patients an ice-bag applied to the shaved scalp will be agreeable. If this cannot be well borne, cloths wrung out in cold water and applied to the head and neck will give relief for the nervous irritability and the fever. Laxatives are indicated, because of the prevailing tendency to constipation throughout the course of this disease. The kidneys, too, must not be forgotten, as retention may occur. The patient should be at absolute rest in a cool, darkened room. All sources of irritation from without, such as noises, bright lights, etc., should be avoided. In recent years draining of the ventricles into the subdural space by lumbar puncture, frequently repeated, has found many advocates. In children, when the fontanels are still open, they are utilized for the same purpose. The benefits are obvious in some cases, but many patients are not at all influenced by any mode of treatment.

Epidemic Cerebrospinal Meningitis

See Volume III, Chapter I.

Tuberculous Meningitis

This type of meningitis occurs most frequently in childhood; the atypical forms are not infrequently seen among adults. The age from two to twelve years seems to be most favorable for its development. A super-

ficial glance at the pathological anatomy of this fatal disease will explain most of the symptoms. It is well to bear in mind that the pathological processes take place principally at the base of the brain, therefore it is also called basilar meningitis.

The tubercles, which are no larger than a millet seed, follow the course of the blood-vessels at the base of the brain pretty closely. The circle of Willis, the Sylvian fissure, the surface of the pons, the lower aspect and sides of the cerebellum are the parts most often involved. The tubercles are often found over the bases of the central convolutions and it is important clinically to remember that the facial twitchings observed in this disease might be produced by this distribution. Postmortem the great lymph sacs at the base of the brain seem to be distended with serofibrinous effusion, so that the arachnoid is forced up, is stretched, and has a milky gray color. Numbers of tubercles can be seen protruding through this milky and opaque superstructure.

The cranial nerves are often found imbedded in the exudate. The superficial layers of the brain may likewise be studded with tubercles, and we may have in addition a meningo-encephalitis.

Through the tela, which carry the choroid plexuses into the interior of the brain, we have extension of the disease, in consequence of which acute hydrocephalus and symptoms of pressure follow.

Symptoms.—All the manifestations of tuberculous meningitis may be classified under general symptoms, mostly caused by pressure, and focal symptoms, caused by direct implication of nerve tissue.

Among the *general* symptoms are: headache, vertigo, vomiting, slow pulse, disturbance of the respiratory rhythm, jactitations, convulsions, hyperesthesia, delirium, coma, involuntary sphincter action. On the border line between general and focal symptoms are spasticity of the extremities and of the masticatory muscles, grinding of the teeth, rigidity of the neck, and probably the transient localized twitchings.

Headache is a very constant symptom and may be caused either by direct pressure of the exudate upon the nerve filaments of the dura, or else indirectly by the fluid from within the ventricles. The fever in tuberculous meningitis is never high, except in the terminal stage, when it may run up to from 104° to 106° F. Its usual range is from 100.5° to 102.5° F.

The pulse at first may be retarded, owing to stimulation of the vagus center in the medulla. Late in the disease, when paralysis of the vagus center begins, the pulse becomes rapid and irregular.

Respiration becomes arhythmical early in the disease and is the result of a moderate amount of brain pressure; when the pressure rises, and when coma has supervened, respiration is deep and slow. When the pressure has become very high, and if the retarded or vagus pulse comes on, respiration becomes irregular and at times ceases altogether. When in

the further course of the disease vagus paralysis manifests itself by the acceleration of the pulse, the respirations become very labored (Cheyne-Stokes), and are finally extinguished.

The clouding of the sensorium is probably due to pressure, also the vertigo and vomiting occurring upon postural changes. Similarly, the optic neuritis—better called papillo-edema—must be ascribed to increased brain pressure and edema of the nerve sheath. Possibly also the pupillary anomalies may be produced by the same cause exerted on the cortical or nuclear centers; pupillary inequalities indicate unequal involvement of the two sides and constitute an important sign.

Meningeal thickening is probably responsible for the various muscular rigidities which cause, in the neck, trismus and opisthotonos, in the trunk, arching and boat-shaped abdomen. The various hyperesthesias of skin and special senses may be similarly explained. The tendon reflexes are exaggerated early in the disease, later they are either reduced or entirely absent. The Kernig sign, as well as the signs described by Brudzinski, are often present, but only their presence is of diagnostic value.

Vasomotor disturbances are common, so that a light stroke over the forehead or chest may leave a red streak for some time. This is the so-called *tâche cérébral* of Trousseau, which was formerly regarded as pathognomonic of tuberculous meningitis, but we now know that it occurs in other nervous disorders.

Constipation is, as a rule, noticed early; later in the course of the disease there are involuntary discharges. The urine may contain small amounts of albumin, sometimes a slight amount of sugar.

Great emaciation is a well-marked feature in tuberculous meningitis, so that in a few days the patient may be reduced to a mere skeleton.

Focal symptoms are caused by the accumulation of tubercles in certain cortical areas with subsequent destruction of brain substance and by direct involvement of cranial nerves. Thrombosis of the Sylvian artery may cause softening of the brain and hemiplegia may result. The most important focal symptoms are the paralyses of cranial nerves, especially of the third (strabismus, pupillary differences, myosis, or mydriasis). Hemiplegias, preceded by symptoms of irritation, such as localized twitchings, are common. Aphasia, particularly of the motor type, is occasionally met with, and may be due either to blocking of the left Sylvian artery or to a tuberculous deposit in the neighborhood of Broca's convolution. Tubercles in the choroid, when found, are of greatest diagnostic import. Optic nerve involvement has already been mentioned.

Diagnosis.—A typical case of tuberculous meningitis rarely, if ever, offers difficulties in diagnosis. It is the atypical cases that tax the physician's diagnostic skill. A correct diagnosis can be made even in the absence of some of the characteristic symptoms, if one remembers the particular grouping of symptoms in this disease: the gradual onset;

the irregular type of fever; the peculiar quality of pulse—irregular at first, then somewhat retarded, and accelerated toward the last; the violent headache; the ocular and facial paralysis; the pupillary differences; the somnolence, convulsions, and coma. All these constitute a symptom group that makes its own diagnosis.

However, there are atypical forms of tuberculous meningitis, particularly in adults, in which diagnosis is almost impossible. For instance, the disease may remain latent or be entirely overshadowed by the primary affection. In some cases there is complete absence of fever or even a subnormal temperature. Delirium tremens has been known to mask the disease; and focal symptoms, such as monoplegia, hemiplegia, aphasia, Jacksonian fits, have occupied the foreground. The last varieties are probably cases of localized tuberculous meningitis that become generalized later. Then there is a form of disease which, under certain circumstances, can be easily mistaken for brain tumor. Of course, this is not likely to happen in the ordinary type of tuberculous meningitis with acute hydrocephalus, which runs a course of from four to six weeks. But there is a chronic form of the disease in which the differential diagnosis from tuberculous tumor is almost impossible, on account of the similarity in symptoms. Allen Starr mentions the following points as of some value: Headache is more severe in meningitis and more continuous; there is greater hypersensitiveness to light, sound, or touch in meningitis; and optic neuritis develops less frequently, less rapidly, and with less intensity than in tumor. Tubercles upon the choroid are found more frequently in meningitis than in tuberculous tumor.

Of all infectious diseases, none has probably more often been mistaken for meningitis than typhoid fever. More than once have I been called to see a case of supposed tuberculous meningitis in which the usual fatal prognosis was given, and which turned out to be a case of typhoid fever with recovery. The symptoms in some cases may be so similar—even aphasia and hemiplegia have been observed in typhoid—that only a positive Widal reaction and a lumbar puncture may definitely clear up the diagnosis.

Certain febrile digestive disorders in children may resemble meningitis in that the patients suffer from headache and pains in the muscles, vomiting, and constipation. There are anorexia, coated tongue, abdominal pain, and sometimes decided photophobia. In addition there may be an irregular fever, ranging from 99.5° to 102.5° F.; the pulse may be accelerated, but regular. Although these patients appear moody, irritable, semistuporous—all symptoms found in the prodromal stage of tuberculous meningitis—yet careful inquiry will almost always elicit the fact that there has been some indiscretion in diet with a rather sudden onset of symptoms. The further course of the disease will invariably settle the diagnosis.

Tuberculous must also be differentiated from acute purulent leptomeningitis. In the latter the characteristic prodromata are lacking; further, it has a sudden onset and a rapid progress; the temperature runs higher and vacillations are infrequent. Cranial nerve involvement is more pronounced in basal than in meningitis of the convexity. Besides, cerebrospinal meningitis, as opposed to the tuberculous variety, has a rapid onset with high fever, and spinal symptoms are present. In the epidemic disease there are early rigidity of muscles, opisthotonos, tremor, jactitation, and often herpes.[2]

After everything has been said, differentiation of one type from another, in some instances, is almost impossible. For this the careful examination of the cerebrospinal fluid will be helpful. It is characteristic, though not pathognomonic, for tuberculous meningitis that the fluid on standing precipitates in the form of small coagula, which adhere to the walls of the tube. When loosened, the coagula separate into flocculi. The tubercle bacilli, for which careful hunt must be made, will usually be found in these fibrin masses. An additional point to remember is that in a cellular count the mononuclear lymphocytes preponderate, very few polynuclears being present.

Treatment and Prophylaxis.—Little can be said regarding any specific treatment of this fatal malady. We have no such serum as has reduced the frightful mortality of epidemic cerebrospinal meningitis. The fatal character of the tuberculous variety of meningitis was recognized ever since the disease has been known. In 1921 Harbitz collected from the literature 40 cured cases. These did not result from any specific treatment used, but occurred under symptomatic medication. Not being, then, in the position of being able to effect a cure, we shall at least make efforts to prevent the development of the disease, if that is possible.

Prophylaxis.—As in other forms of tuberculosis, two factors are necessary to produce the disease, namely, (1) a hereditary predisposition to tuberculous disease, and, what is even more important, (2) a source of infection. It will be our aim to so regulate the patient's life as to prevent or make it difficult for tubercle bacilli to find lodgment in his economy. A child known to be predisposed to tuberculosis should not be brought in intimate contact with those suffering from the disease. It must be kept out of doors most of the time during the day. Windows of bedrooms should be kept open day and night. When the child is old enough to attend school it must be carefully guarded against too strenuous school tasks. Strict attention should be paid to school hygiene in every detail. If the public school does not comply with the hygienic requirements, the child should be sent to a well-regulated private school.

In addition there is to be observed *local prophylaxis,* which means the

[2] Occasionally mixed infections of the meninges with the tubercle bacillus and the meningococcus or pyococci occur.—Editor.

prevention of the spread of disease from sources on the patient's own body, by so-called auto-infection. Wherever tuberculous glands are discovered on the patient, they must be promptly dealt with both medically and surgically. Any existing tuberculous disease of the nose or pharynx requires constant attention so as to prevent its spread to the cerebral membranes. Another prolific source for the dissemination of tuberculosis is the osseous system. Tuberculous caries and periostitis should be treated according to the best rules of our art.

Treatment of Symptoms.—In the fully developed disease we treat symptoms as they arise. The treatment does not differ from that already outlined for the other varieties of meningitis. In the presence of this disease we are powerless to effect cures, but we may relieve symptoms. A few years ago the administration of iodoform, so helpful in other forms of tuberculosis, was tried, but without success. When the tuberculin era began, much was hoped from tuberculin injections. Our experience has been that not only were patients not benefited by its use, but some even become worse as a consequence. At present only few physicians continue to use tuberculin in this affection.

Operative Treatment.—By reducing the pressure in the cerebrospinal fluid it was thought that symptoms might be relieved and time gained for the disease processes to become regressive. For this purpose the ventricles are being drained by means of brain puncture. The effects obtained are transient in character and discourage a continuance of this procedure. *Lumbar puncture* enjoys greater popularity. Fürbinger used lumbar puncture in 37 cases, but the results were unsatisfactory; none of his cases showed permanent improvement. Neither can Heubner boast of lasting favorable results, but he saw temporary improvement in some of his cases, especially as regards the relief of pain. Freyhan reports that, after the removal of 60 c.c. of cloudy serous exudate, one of his patients began to convalesce, and in three weeks more he left his bed well. In this case the cerebrospinal fluid showed tubercle bacilli. Henckel published a similar case. Riebold achieved a complete cure in one of his cases by daily lumbar punctures. The fluid contained numerous tubercle bacilli and inoculation tests were positive. Rieken has recently tried lumbar puncture in 6 cases from Quincke's clinic; all died. There are still other reports of cures by this method. It must be admitted, then, that lumbar puncture often relieves symptoms, and that exceptionally tuberculous meningitis may be cured by it.[3]

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[3] It is the method of treatment which should be employed in every case. Aside from the possibility of cure, the symptomatic relief given is so great that the whole clinical picture is changed by it. While I have never been so fortunate as to have any one of my cases recover, the absence of pressure and toxic symptoms has done away with much suffering, both to the patient as well as to the family. The duration of the disease, it has seemed to me, has been prolonged by this treatment.—Editor.

Chronic Cerebral Meningitis

From the clinician's point of view this disease is of little importance. The majority of cases occur in connection with brain syphilis. The acute and subacute cases of cerebral meningitis occasionally merge into the chronic type. Chronic meningitis occurring in an individual who has had syphilis, especially if mental symptoms are prominent, means the coming of general paresis. In connection with active syphilis, chronic cerebral meningitis may cause optic atrophy terminating in blindness. In the large majority of cases chronic meningitis is caused by luetic infection, chronic alcoholism, or general paresis. In frankly syphilitic cases the disease limits itself to the base of the brain, while in the alcoholic and paretic varieties the convexity is principally involved. Rarely internal hydrocephalus terminates in chronic meningitis; then the cerebellar cortex and the ependyma of the ventricles may be the seat of the disease.

Treatment.—This will be entirely etiologic. If syphilis be the etiologic factor, energetic antisyphilitic treatment is indicated. In general paresis the Swift-Ellis method may be tried. These patients should receive the benefit of this treatment, as it is not always possible to determine the degree of active syphilis still present in cases presenting the clinical signs of general paresis. In chronic meningitis, the result of an acute type in which hydrocephalus is present, lumbar puncture or ventricular tapping may be tried. Cures have been reported from such treatment.

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CHAPTER XIII

CIRCULATORY DISORDERS OF THE BRAIN

JULIUS GRINKER

CEREBRAL ANEMIA

Introduction.—Formerly much space was given to descriptions of anemia and hyperemia of the brain. Both of these circulatory disorders were discussed as morbid entities; their etiology, symptomatology, and pathology received lengthy mention, but very little of value was said under the heading of treatment. At the present time cerebral anemia and hyperemia are spoken of as symptoms of functional or organic disease; consequently they receive but scant consideration in the modern textbook. From the point of view of therapy, however, these conditions merit more than passing mention. Much can be done to ward off a serious attack of brain disease if the preceding vascular symptoms can be recognized and treated at an early stage.

Cerebral anemia is often only part of a general anemia. Quite frequently it is produced by a feeble condition of the heart, causing so-called syncope. In the brain itself it is possible to have a localized anemia from neoplasm, vascular thrombosis, or hemorrhage; hydrocephalus may also produce it by pressure upon the surrounding tissues. We distinguish between total and partial, acute and chronic forms of anemia.

Symptoms.—1. In the *acute* variety of cerebral anemia we have the ordinary symptoms of syncope. The patient experiences a drowsy feeling and falls into a "faint." There appear dimness of sight, ringing in the ears, and inability to remain standing. In addition there are noticed pallor of the face, coldness of the extremities, sighing respiration, and feeble heart's action. If this state continues, consciousness may be lost and general convulsions appear, possibly ending in death.

2. In the *chronic* variety the patient experiences subjective sensations of tingling and numbness in the extremities and a peculiar dull pressure-headache. Black spots may be seen before the eyes, or there may be heard noises and ringing in the ears; giddiness is more or less constant. Physical and mental weakness may be so marked that even to

speak is a great effort. In the severer grades of anemia a somnolent or stuporous state develops, with delirium, picking at the bedclothes, and inability to sit or stand. The special senses may be functionally impaired, so that the patient cannot see or hear distinctly.

Prognosis.—The prognosis varies according to the underlying conditions and the patient's constitution. It would appear that the more rapidly symptoms develop the worse is the outlook for recovery.

General Treatment.—Prophylactic treatment is directed against the various causes of general and local anemia, which is discussed under a separate heading.

Treatment of the Acute Attack.—To combat this no time should be lost by the attending physician. The objective point is to cause immediate improvement of the cerebral circulation. It is absolutely essential to have the patient placed in a horizontal position, in order to determine a better flow of blood to the brain. In some cases it is best to raise the lower extremities and to depress the head, in order to permit the bloodless brain to receive an adequate supply of blood. When necessary, this position may be maintained for days and weeks. Tight bandaging of the extremities, for the purpose of emptying the blood and forcing it into the brain, has been tried with success. All mechanical obstruction about the patient's body, such as close-fitting dresses, corsets, etc., should be removed or loosened, in order to stop interference with the proper circulation toward the brain. At the same time it becomes necessary to cause stimulation of the cardiac and respiratory functions.

Externally, cold water is to be dashed upon the face and the body flapped with towels dipped in cold water; mustard plasters are applied to the region of the heart. Cold can be alternated with hot towels and placed over the body, leaving out the head. Sinapisms may be put upon various portions of the chest and back, shifting from one spot to another. Ammonia, or spirits of camphor, may be advantageously applied to the nostrils. In cases showing a tendency to persist we stimulate the skin by means of the faradic brush and apply the electric current to the sides of the chest and over the region of the heart.

Internally coffee, alcohol, or ether are of decided benefit. Champagne is an efficient remedy. Repeated hypodermic injections of ether in doses varying from 10 to 30 drops have been found efficacious in reviving a flagging heart. Oil of camphor has been used in the same manner and for the same purpose. Hoffman's anodyne in teaspoonful doses and 10 to 20 drops of ether on a lump of sugar are some of the other remedies advised. When life appears to be threatened in either acute or chronic cerebral anemia, we do not hesitate to resort to transfusion of normal salt solution, as by this means many patients have been saved from almost certain death.[1]

[1] Transfusion of blood may also be used in the severe cases.—Editor.

For the obstinate sleeplessness of chronic cerebral anemia nothing equals in efficacy the imbibition of a night draft, consisting of either a glass of beer, wine, or even whisky in small quantities. With this may be combined the postural treatment, namely, horizontal position of head and elevation of feet. In many cases this alone is sufficient to produce sleep. The administration of bromids in anemic conditions of the brain is to be deprecated, for this is certain to aggravate symptoms.

An acute attack of cerebral anemia being frequently only a symptom of some chronic disorder, it becomes imperative to search for the cause and, when found, to apply the appropriate remedy. If cardiac conditions are found to be the underlying etiologic factor, treatment will be directed to the heart. When the lungs are at fault they must receive treatment. A blood examination is to be made in every instance. Each organ should be investigated in its turn and treated according to the rules discussed in other portions of this work.

The nervousness often accompanying cerebral anemia requires perfect rest in bed, good food, and ferruginous tonics. The Weir Mitchell rest cure in all its details will here find a most fertile field for useful application.

HYPEREMIA OF THE BRAIN

Introduction.—Like cerebral anemia, this condition is not a disease entity, but constitutes an important symptom in several functional and organic diseases. The early recognition and treatment of it, however, may delay the advent of serious organic disease, of which it may be a remote or immediate warning.

We distinguish between active and passive hyperemia of the brain; also between general and partial, acute and chronic cases.

Active Cerebral Hyperemia.—Some deny that this type of hyperemia is ever a distinct pathological condition, maintaining that a certain degree of active hyperemia is physiological during mental labor, and that it is difficult to draw a line between the pathologic and the physiologic. Most writers, however, are of the opinion that there is a pathological type of active hyperemia, which is induced by mental exertion or emotional stress. Excessive cardiac activity with or without hypertrophy of the heart is a common cause. Fluxes to the brain by insolation, infection, intoxication—especially alcoholic—tea, coffee, and other stimulating beverages, are capable of producing active hyperemia in the brain. Cerebral inflammation and tumors are often accompanied by local hyperemia in their vicinity.

Passive Hyperemia.—Passive hyperemia can be caused by anything which prevents the flow of blood to the brain. The obstruction may be central, such as cardiac lesions at the mitral or tricuspid valves are capable

of producing, or there may be a hindrance in the pulmonary circulation. Passive congestion of the brain may also be caused by tumors or enlarged glands pressing upon the veins of the neck or in the axilla, in this manner preventing the return flow to the heart. Among the intracranial causes of this condition must be mentioned tumors of the brain so situated as to press upon the vascular structures, particularly the vena magna, or veins of Galen.

Symptoms.—Both active and passive hyperemia of the brain are characterized by a feeling of increased pressure and heaviness in the head, vertigo, and cephalalgia. In the lighter grades of active hyperemia there is a sensation of heat and fullness in the head, which often prevents sleep. In addition the eyes are blurred; there is an inability to see objects distinctly, or there may be ringing in the ears; also pulsation of the cerebral arteries with thumping headache. In the severer grades of this affection there may be stupor, cloudiness of the sensorium, confusion of the mind, and peculiar twitchings. In these cases convulsions, transient paralysis, and mild aphasia are not rare.

In the passive variety of cerebral hyperemia symptoms of heaviness, somnolence, and depression prevail.

Prognosis.—The prognosis of cerebral hyperemia depends upon the cause. The condition itself usually passes off, except when it occurs as an initial warning of cerebral hemorrhage, in which case it is followed by an attack of apoplexy.

Prophylaxis.—Hygienic measures for the prevention of cerebral hyperemia include the avoidance of mental and emotional stress. Individuals with atheromatous arteries and those suffering from syphilis are particularly warned to avoid pursuits in which the element of hazard subjects them to occasional "nerve storms," as these may first cause hyperemia and later hemorrhage from vessels of the brain. For similar reasons excessive study and games of chance are unsuitable for such individuals. Stuffy, overheated rooms should not be frequented, and in consequence theaters and parties are better left alone. The hygiene of occupation requires cool, airy rooms to work in; that of recreation demands that mental labor should be alternated with muscular exercise in the open air. Swedish movements are excellent for this class of patients. Of outdoor sports horseback-riding has many advocates, as it has a tendency to draw the blood from the brain to lower parts and to give the rider a feeling of exhilaration. It has also been found very efficacious against insomnia, a troublesome symptom in cerebral hyperemia. Brain workers who suffer from abnormal fluxes of blood to the cerebrum must be persuaded to take up some form of manual labor; best of all farming.

Patients must not partake of large meals. The food must be digestible and assimilable; small meals frequently taken are preferable to the three-meal system. The ideal diet, if it can be carried out successfully,

should be vegetarian. Midnight suppers are to be banished. No alcoholic drinks are permitted, especially in the evening, before bedtime. Coffee and tea are to be given over to those differently constituted. Tobacco, except in very small quantities, acts injuriously by promoting cerebral hyperemia through its effects upon the heart. In brief, prophylaxis against cerebral hyperemia consists in a well regulated life with good habits, a moderate amount of mental labor, with some outdoor exercise. These rules apply equally to those cases which are a result of, or accompanied by, nervous or visceral organic disease.

As passive cerebral hyperemia is not an independent affection, but nearly always the result of disease elsewhere, such as heart and lungs, these organs must be treated. In such cases it may be necessary to use digitalis, strophanthus, or strychnia, if the heart be the organ at fault.[2]

In respiratory affections with frequent cough small doses of opium may be prescribed, in order to prevent a damming back of blood into the brain. If the congestion is caused by glands or tumors pressing upon the veins of the neck, they should receive surgical attention.

General Treatment.—An attack of *acute cerebral hyperemia* requires immediate energetic action; delay may mean the development of cerebral apoplexy. The patient must be placed in a cool, dark room, with the head elevated, in order to prevent the flow of blood to the brain and to divert the blood current to the extremities. All tight clothing about the body should be loosened to permit free respiration, thus accelerating the flow of blood to the heart.

An ice-cap should be placed upon the head after the hair has been thoroughly moistened with cold water. Cold ablutions to the head and spine are also useful. Physicians do not, as a rule, recommend *general* cold baths, but there is no more powerful remedy, when properly used, to determine a flow of blood through the skin and away from the brain. It must always be remembered that before and after the bath ice or ice-cold applications should be applied to the head. In old people with atheromatous arteries cold baths are not to be used; neither can very hot baths be recommended. In mild cases of cerebral hyperemia cold foot-baths have given immediate relief. The feet are allowed to remain in the water ten or fifteen minutes, or until the reaction occurs, which is a reflex contraction of the blood-vessels in the brain. Some advise the addition of mustard flour to each bath, others order the legs and feet to be kneaded and massaged while the patient remains in the bath.

Withdrawal of Blood.—Direct withdrawal of blood will effect a rapid reduction of the entire volume of blood in the brain. Local bloodletting,

[2] Arteriosclerosis should be looked for in all of these circulatory cases. In my experience this is the cause in the greater number of patients. Certainly more relief is given, and more patients are cured, by the treatment of arteriosclerosis than by any other mode of treatment.—Editor.

leeches (in small children one to two, in adults six to eight), cupping, wet or dry, occasionally act efficaciously. Blood may be taken from the back of the neck at the junction of hair and skin, from the region of the mastoid processes, the temples, and inner angles of the eyes, and also opposite the longitudinal sinus.

In a plethoric individual with symptoms of threatening hemorrhage immediate withdrawal of large quantities of blood may prevent the attack. Before resorting to bloodletting, however, one must ascertain that the heart is powerful and the pulse tense and full. General bloodletting is contra-indicated in cases with pale face, small and feeble pulse, irregular heart action, and particularly in the anemic and the senile with atheromatous arteries. We are to be especially careful in the last type of patient, as he is prone to develop thrombosis, and we may hasten this process by bleeding. In addition to direct withdrawal of blood by venesection or cupping, we aim to deflect the blood current from brain to distal parts of the body by other means. For this the various laxatives are utilized, particularly the salines, such as Rochelle salts, Hunyadi water, and Carlsbad salts. Of cathartics croton oil takes the lead. The dose is 2 drops, made into an emulsion, and repeated every half hour until purgation occurs. Infusion of senna leaves, 3 to 4 tablespoonsful every two hours, until effects are procured, is a favorite remedy with some. Others prescribe jalap, rhubarb, and calomel in combination, or calomel alone in 5-gr. doses, followed by salines; also castor oil, in 1 to 2 tablespoonful doses.

Diaphoretics are sometimes beneficial. Antipyrin, 5 to 10 gr. (0.3 to 0.6 gm.) three times daily; phenacetin, in 5 to 10-gr. doses (0.3 to 0.6 gm.), and the salicylates, may be given alternately, for these remedies deplete the circulation by causing perspiration and reduction of pressure in the arteries. Patients must be warned to partake of fluids but sparingly, as any extra amount of liquid increases the heightened arterial tension.

Symptomatic Treatment.—In congestion of the brain, accompanied by restlessness, convulsions, delirium, or spasm, the administration of nerve sedatives is indicated. They are not to be used in those depressed patients who are somnolent and threatened with coma, nor in those with weak heart and a rapid pulse. Sedatives can be given by mouth; in some instances morphin, gr. 1/10 to 1/5 (0.006 to 0.012 gm.), hypodermically, is to be preferred. In cases of vomiting, restlessness, and delirium, it is better to give chloral hydrate per rectum, in doses not exceeding 30 gr. (2 gm.) every three hours, until relief is obtained. When there is danger of collapse, stimulants should be administered with a free hand. In severe grades of hyperemia treatment must be directed toward the prevention of paralysis of the respiratory and cardiac centers. The heart must be stimulated with injections of camphor, strychnin, alcohol, ether, or

musk. Externally sinapisms, turpentine, and hot applications are used to the lower extremities, while the head is kept cool by ice. It is in these severe cases that local and general bloodletting save lives.

Treatment of Chronic Hyperemia.—Chronic hyperemia is treated upon an etiologic basis. Proper hygiene and the avoidance of mental stress and alcohol in any form must be insisted on. A wholesome, non-stimulating diet and moderate outdoor exercise are other prophylactic requirements. The indications here are to so regulate one's life as to prevent constant overfilling of the cerebral vessels. Only exceptionally is bloodletting necessary. It is here that horseback riding and Swedish gymnastics celebrate their greatest triumphs. The diet should consist of easily assimilable and digestible food, preferably vegetables, fruits, such as pears, prunes, and apples. Meat and alcoholic stimulants are natural enemies of the chronically hyperemic. Turkish, Roman, and other hot baths are not to be indulged in by this class of patients. There can be no objection to the use of cold foot-baths, or the so-called Sitz bath. Daily cold ablutions to spine and head are recommended. The temperature of the bath must be adapted to the age, strength, and the reactive abilities of each individual. The surest proof that the bath is beneficial is when the patient feels refreshed after it and can readily get warm; otherwise it does harm.

One of the most difficult problems in chronic cerebral hyperemia is how to overcome the insomnia. This symptom, to be properly treated, requires a thorough examination of all etiologic factors. The patient's habits, diet, occupation, time of work, sleep, state of strength, will all have to be scrutinized with a view to correct faults. The main point in the treatment is strict regulation of the patient's mode of life, the removal of everything that may banish sleep, the reduction of mental labor, and the increase of physical exercise appropriate to the individual's strength. In acute cases of insomnia we must not despair, for we still have at our command the various hypnotics, of which sulphonal, luminal, veronal, are only a few. In exceptional cases, and only occasionally, morphin in a single large dose may be administered. Under no circumstances must any of these drugs be left to the indiscriminate use of the patient himself.

In chronic cases of insomnia sleep-producing remedies are better avoided altogether. On the other hand, bromid of sodium or potassium in moderate doses, say 15 gr. (1 gm.) three times daily, is highly recommended by Hammond and others.[3]

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[3] A reliable preparation of ergot combined with the bromids has been very serviceable to me in these cases. For many years I have used this combination in all forms of cerebral hyperemia for symptomatic indications. It may be given for a long time, but when evidences of brominism develop the ergot can be continued without the bromids. In many instances ergot alone is beneficial.—Editor.

An excellent remedy is rubbing the spine and head with a Turkish towel dipped in ice-cold water once or twice during the evening, or even at night. Sufferers from insomnia should not work after 6 or 7 in the evening, should eat small meals at night, must take walks in the fresh air, avoid sleeping in the daytime, rise early, and discard coffee, tea, and liquor.

The treatment as outlined is applicable also to cases of cerebral hyperemia occurring with organic intracranial disease.

CEREBRAL HEMORRHAGE

Hemorrhage may occur in the brain membranes or in the brain substance itself. Clinically the various kinds of hemorrhage in the cranial cavity cannot always be differentiated. From a therapeutic point of view all varieties may be included in one large group, as the treatment is practically the same regardless of the location of the hemorrhage.

Etiology.—Two factors are required to produce cerebral hemorrhage: a diseased artery and an increase in blood-pressure. The hypertension in the arteries is often associated with chronic interstitial nephritis. The vessels are atheromatous, and miliary aneurysms have been found on them. It is by the giving way of an artery whose walls had been weakened by disease that hemorrhage is possible. In the presence of congestion, or increased blood-pressure, in diseased arteries, we have hemorrhages, either large or small, depending upon the caliber of the vessel.

There is a type of hemorrhage which occurs during or after birth, which is commonly due to the mechanical force applied to the head, either by a narrow parturient canal or by the forceps. These hemorrhages are mostly meningeal and bilateral. Some of the infectious diseases of childhood may give rise to hemorrhage, particularly when there is sinus thrombosis present. Charcot and Bouchard, in 1864, first described the small aneurysmal dilatations frequently seen in those arteries which have given way in hemorrhage, and the majority of physicians still believe that the weakening of the vessel wall is the principal cause of hemorrhage in the brain. As the ganglionic arteries from the circle of Willis are oftenest the seat of this pathological change, hemorrhage occurs in them with great frequency. Of these the most common seat of hemorrhage is in the small artery supplying the lenticular nucleus, which Charcot named the artery of hemorrhage, otherwise called the lenticulostriate artery. Hemorrhages may also occur in the region of the pons, cerebellum, corpora quadrigemina, and medulla.

The age of hemorrhage is between forty-five and sixty-five, the very time of existence when, by chronic alcoholism or repeated physical and mental stress, the arteries begin to degenerate.

Although thrombosis is the more usual lesion, yet syphilis is a factor in about one-third of all cases of hemorrhage. Hemorrhage in the brain is not uncommon in purpura hæmorrhagica, pernicious anemia, and the various hemorrhagic diatheses.

In a case predisposed to hemorrhage the attack itself is often caused by coughing, sneezing, lifting of heavy weights, straining at stool, coitus, or by severe emotional disturbances, such as fright and anger. Even intense joy has been known to bring about an attack.

Symptoms.—One may speak of headache and giddiness as premonitory symptoms of hemorrhage, if they occur in those whose arteries are likely to rupture. Even ptosis and transient diplopia have been observed to precede an attack of cerebral hemorrhage. In many cases the symptoms of cerebral congestion may have been present, but failed to attract attention. Hemorrhage of the brain usually begins suddenly, with a so-called "stroke," a name formerly applied exclusively to this vascular affection.

The symptoms are divided into (1) *general,* common to all hemorrhages of a certain size irrespective of situation; (2) *local* symptoms, which indicate their position.

1. The principal *general* symptoms are: sudden loss of consciousness, varying from slight confusion to deep coma; stertorous breathing, which may be of the Cheyne-Stokes type; full pulse, subnormal temperature, and loss of control over the sphincters.

2. The *local* symptoms will vary with the position of the hemorrhage. As previously stated, the branches of the middle cerebral artery are particularly prone to rupture, and of these the lenticulostriate is especially liable. Hemorrhage from this small artery, which supplies the lenticular nucleus having the motor tract on its inner side, will give rise to symptoms of paralysis on the opposite side of the body, so-called contralateral hemiplegia. This is the most common motor paralysis of cerebral hemorrhage. A knowledge of cerebral localization will enable one to interpret properly any of the motor symptoms to be found in hemorrhage taking place in other parts of the brain. In most cases of hemorrhage the patient, who may have been standing, suddenly feels giddy, and, after reeling for a few seconds, sinks to the ground or into a chair, and quickly loses consciousness. The physician usually finds his patient in this state, with stertorous breathing, a full, slow pulse, turgid face, and perhaps conjugate deviation of the eyes, that is, with the eyes and face persistently turned to one side.

Diagnosis.—The diagnosis is easy in the majority of cases; at times, however, it may be extremely difficult. One will frequently have to differentiate between this and thrombosis, embolism, and syphilis. In hemorrhage there is a seizure or so-called apoplexy during which the in-

dividual is, as it were, suddenly struck down. Convulsions and conjugate deviation of the eyes, loss of consciousness, and Cheyne-Stokes respiration are characteristic of the attack itself. Paralytic phenomena, most commonly hemiplegia, become evident later. The differential diagnosis will be referred to when discussing thrombosis and embolism of the cerebral arteries.

Prognosis.—The prognosis of hemorrhage is grave in all cases. Many patients die in the first attack; many more during a second or third stroke. The outlook is largely governed by the size of the torn vessel and by the situation of the hemorrhage. If the pons or medulla be the seat of the lesion, death is almost certain. If a very large vessel is ruptured, hemorrhage is profuse, and blood may invade either the ventricles or the surface of the brain. In either case the prognosis is hopeless. In most cases of apoplexy with fatal termination death is caused in this manner. Those who have survived the direct effects of cerebral hemorrhage have bled from a small vessel. The outlook in the milder cases is far better than in either thrombosis or embolism. While in the latter softening and cicatrization of the affected brain substance are the cerebral changes, in hemorrhage there is usually only pressure upon the motor tracts. With the shrinking of the blood-clot, therefore, restoration of function in the motor tracts may take place even weeks and months after the "stroke."

Extensive meningeal hemorrhages in children and intraventricular hemorrhages in adults are of serious import; death is the usual outcome. Large hemorrhages may become fatal by compression of the brain itself. In addition, it must be recollected that hemorrhages may recur, one of which, if sufficiently extensive, may kill the patient. Besides, the underlying diseases, such as interstitial nephritis and arteriosclerosis, are in themselves serious enough to cause a fatal issue. In many cases "acute bed-sore" and intercurrent disease, most often inflammation of the lungs, cause a fatal termination.

Prophylaxis.—Prophylaxis will concern itself with the treatment of the underlying causes—arteriosclerosis, chronic alcoholism, syphilis, or kidney disease.

Hygienic Measures.—The patient's mode of life is to be regulated so as to prevent congestion and fluxes of blood to the brain. Anything which may have a tendency to excite the emotions must be avoided. Social gatherings, political activity, and hazardous games of all kinds must be abandoned and exchanged for a quiet, rural, or at least unexciting existence. The diet must be bland; should consist mostly of vegetables, milk, and fruit. Small meals, frequently repeated, are better than few large ones. Spirituous liquors are to be avoided, and physical and mental labor should be reduced to a minimum. A long stay in the country, or in a health resort, is to be recommended. Patients should be warned against the taking of hot, Russian, or Turkish baths. They may bathe in lukewarm

water, and can have cool foot-baths and so-called sitz baths. Cold douches are not to be used on the head and face. Laxative remedies, such as Carlsbad Sprudel salts, Hunyadi Janos, Friedrichshall water, and other salines, are advised to produce regular daily evacuation of the bowels.

Systematic gymnastic exercise is beneficial in preventing congestion of the brain; provided, however, that all strenuous movements are avoided, especially those requiring the lowering of the head, for reasons that are obvious. Neither heavy lifting nor jumping should be permitted. Those affected with degenerative arterial disease and sufferers from cerebral congestion and increased heart action should not indulge in bicycle-riding, ball-playing, or rowing. A moderate amount of horseback-riding favors the flow of blood to parts other than the brain. The triad, intoxication, constipation, and excitation, is to be shunned by those who have tendencies to cerebral hemorrhage.

General Treatment.—A patient seized with a stroke of apoplexy, the result of hemorrhage, should be placed in bed with head high and feet low. All tight clothing about the body is to be loosened, and corsets are to be removed. Ice or cloths wrung out in ice water should be placed upon the head and frequently renewed, while the feet are put in vessels filled with hot water. To quiet the heart's action an ice-bag may be applied to the cardia. To attract the blood to the intestines a drastic purge may be administered; preferably 1 or 2 drops of croton oil in 5 of sweet oil are placed on the tongue. The patient should be kept perfectly quiet. Movement of any kind is strictly prohibited. Aconite and veratrum viride, in 1 to 2 minim doses every hour, are classical remedies to reduce violent heart action. The suggestions previously given when speaking of cerebral congestion may be here applied with benefit.

In plethoric and robust individuals venesection is indicated. On several occasions I have seen beneficial results from the withdrawal of large quantities of blood in comatose patients. In many cases no good is accomplished by this measure. From 10 to 12 ounces (300 to 360 c. cm.) of blood can be withdrawn if the pulse continues tense. The beneficial effects of bloodletting are shown by cessation of convulsions and a return to consciousness. When the hemorrhage into the brain is very extensive, bloodletting will be of no avail. Bleeding seems to do good in the milder cases only.

For the extreme restlessness sedatives and narcotics may be used either by enema or hypodermically. We may give by enema fair-sized doses of chloral hydrate combined with bromids. Morphin may be injected hypodermically in doses of gr. ¼ to gr. ½ (0.015 to 0.030 gm.).

In those cases in which the diagnosis is doubtful, or rests between hemorrhage and thrombosis, to do nothing is better than to do too much. While waiting for developments several important matters demand the conscientious physician's attention. The bladder must be catheterized

once in three or four hours; if this is not done, retention with cystitis is likely to result, which complication is alone sufficient to cause death. The patient's posture requires frequent change in order to prevent hypostatic pneumonia, another complication which frequently carries off the patient, even after he has survived the attack. The lungs require examination within twenty-four hours and frequently afterward. In order to guard against hypostatic congestion and pneumonia, the patient should be turned over to the opposite healthy side, that is, toward the side of the lesion in the brain. This has the effect of facilitating respiration, and tends to prevent the blood from gravitating inward toward the ventricles. A serious danger occasionally following cerebral hemorrhage is "acute bed-sore," which must be prevented, if possible, as deaths from this cause are common. By scrupulous cleanliness and frequent change of position, it is often possible to prevent decubitus. When an abrasion is found, aseptic and antiseptic dressings should be applied at once and the patient placed upon an air-cushion or water-bed. No fear need be felt regarding food. If the patient feels hungry, he may be given cold milk for the first three or four days; this will suffice to keep him alive. During the semiconscious state, when swallowing is impossible, peptonized milk may be introduced into the stomach by means of a nasal tube, to which is attached a fountain syringe.[4]

For the rest, symptoms should be watched and combated as they arise. There is sufficient work left for the physician if he attends to bladder, bowels, diet, strict cleanliness, and complications.

A danger that awaits especially the case of apoplexy from hemorrhage during the first few days is the development of cerebritis in the neighborhood of the clot. This complication manifests itself by sudden rise of temperature, convulsions, and a recurrence of the comatose state. The treatment is antipyretics, ice to the head, cool sponging, and laxatives.

After-treatment.—The after-treatment of cerebral hemorrhage concerns itself with efforts to cause absorption of the extravasated blood and to remove the paralytic phenomena. For the former the administration of small doses of iodids, 5 to 10 gr. (0.3 to 0.6 gm.) three times daily, has become the classical remedy. For the paralysis massage and electricity are to be employed. The galvanic current applied to the brain was a favorite method in former years, but very few still persist in its use, as galvanism when applied to the brain appears to be entirely devoid of therapeutic benefit, and has done harm in some instances. On the other hand, faradization of the paretic muscles is strongly indicated. Treatment should be begun early, within a fortnight after the stroke, or after the active symptoms of the attack have subsided. Systematic passive

[4] Many of the pneumonias following cerebral hemorrhage are due to the entrance of food into the air passages while the patient is unconscious. Great care should therefore be exercised to avoid this as indicated above.—Editor.

and active exercise of the paretic limbs have the highest indorsement. Experimentally it has been proven by H. Munk that passive movements of five minutes' duration twice daily were sufficient to prevent secondary contractures in the paralyzed limbs of animals, while after a discontinuance of passive exercises contractures appeared which did not yield to any amount of passive movement undertaken subsequently. Passive exercises should be begun two or three days after a stroke and be continued for months.

In the application of massage and electricity it is important to remember that only the weak muscles need stimulation; the stronger ones are already too powerful, and, being unopposed, produce the various contractures. Indiscriminate stimulation of muscles is worse than useless. As the extensors of the upper extremity and the anterior and external group of muscles in the lower extremity appear to be the ones mostly affected by the paralysis, these alone should be stimulated. The patient should be encouraged to stand and walk as early as the second or third week after an attack. The sickle gait in hemiplegia can be largely prevented if patients will make efforts to walk properly, by constantly focussing their attention upon the act of walking, which latter has normally become an automatic function.

The use of splints of cardboard to straighten an overflexed hand and fingers may occasionally overcome obstinate contractures. A splint so shaped as to keep the foot at right angles to the leg is often useful in preventing the contracture of the foot in hyperextension. To be successful all of these measures must be resorted to very early in the case, before deformities have appeared.

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CHAPTER XIV

CEREBRAL SOFTENING

(*Encephalomalacia*)

JULIUS GRINKER

THROMBOSIS

Etiology.—The underlying conditions which lead to thrombosis of the cerebral vessels are arteriosclerosis and low blood-pressure with or without heart disease. The period when both conditions are encountered is old age, as the vessels then become hard and the circulation slow. In middle age syphilis enters as a factor by the production of endarteritic deposits in the arterial coats, favoring clotting within them. The syphilitic variety of hemiplegia is the most common, on account of the extreme frequency of the disease in middle age. Softening of the brain, literally speaking, is more often the cause of death in the aged than is hemorrhage. In some instances, as in the anemias and in some types of septicemia, the cause of thrombosis depends upon changes in the composition of the blood. Blocking of the cerebral arteries may also take place as a result of influenza, scarlet fever, and typhoid fever. In the latter disease we have cardiac weakness with lowered blood-pressure, conditions favoring clotting.

Symptoms.—The symptoms depend entirely upon the mode of onset and the locality of the vessel that is thrombosed. When a vessel becomes narrowed gradually, it produces symptoms by diminution of the blood supply to a certain part of the brain, that is, by the production of cerebral anemia. The function of the part is not altogether lost, but merely impaired. Complete restoration of function is still possible when the circulation becomes reëstablished. As a rule, other attacks follow, and eventually complete thrombosis occurs, and with it paralysis of one-half of the body—hemiplegia. The warnings in the form of temporary loss of power in a limb, an eye muscle, or an eyelid are due to the incomplete blocking of vessels. Some of the forerunners of a thrombotic hemiplegia may be a slight loss of memory, transient or partial aphasia; or a patient may

complain of tingling, numbness, or weakness in an extremity several days or hours before a complete attack of thrombosis has developed. If a branch of the middle cerebral artery supplying the motor area becomes the seat of thrombosis, there will be loss of power corresponding to the extent of brain affected. In many cases there is gradual extension of thrombosis into other branches of the same artery, and we then have an increase in the paralysis—at first possibly only a monoplegia, later a hemiplegia. In thrombosis loss of consciousness is not the rule, though when a very large artery is the seat of the process this may occur. The usual course is for paresthetic sensations to appear first, then a slight loss of power, and finally complete paralysis. The convulsions, twitchings, and jactitations which are so frequent in hemorrhage of the brain are uncommon in thrombosis. Symptoms depend entirely upon what portion of the brain is affected; we may have motor or sensory aphasia, hemianopia, hemianesthesia, hemiplegia, or monoplegia. If the thrombosed artery belongs to the posterior portion of the brain, supplying the cerebellum, we shall have cerebellar ataxia, a reeling from side to side—the so-called drunken gait. We may have nystagmus—a peculiar oscillatory movement of the eyeballs—from interference of function in the corpora quadrigemina, when the vessel supplying them has become thrombosed. Cranial nerve involvement occurs when the affected artery is one that feeds the nerves at the base of the brain.

Pathology.—When a portion of the brain is deprived of its proper blood supply by clotting having taken place in the vessel nourishing it, softening and necrosis are the result. The area so affected may be pale at first, but soon there is an infarct with transudation of blood from surrounding tissues, and the mass may appear red, later yellow. We speak of red and yellow softening according to the coloration produced by the blood. In the later stages a cyst or a scar may be found at the site of a former thrombosis. It must be remembered that, besides softening, which takes place as the direct result of thrombosis, there is edema of the surrounding parts. The symptoms caused by the secondary edema may be more intense than those from direct damage to the brain, but the former soon disappear, while the latter are permanent. This explains the improvement which occurs after a thrombosis, when one would expect none from the irreparable damage done to the brain.

Prognosis.—As the blocking of an artery causes total or partial starvation of that part of the brain which is entirely dependent on it for nutrition, it can easily be understood why the injurious effects of thrombosis are more or less permanent. A mass of brain tissue, once destroyed, can never be regenerated. It is otherwise with the area surrounding the thrombus, in which, as previously stated, there may only be a transient edema. These portions of the brain, when supplied with blood by collateral circulation, may recover function. While the prospects for re-

covery of function are unfavorable in all forms of thrombosis, this is especially true for the internal capsular area; here the arteries are terminal and collateral circulation is impossible. The result is usually permanent softening. In those cases in which the mind has suffered the prognosis is especially unfavorable.

Physicians have long entertained the view that the prognosis is good in thrombosis due to arterial plugging from syphilitic endarteritis. All that was necessary for their recovery was believed to be the administration of vigorous antispecific treatment. Nothing is more erroneous. A complete arterial blockade—irrespective of how produced—which persists forty-eight hours or more causes death of the part depending upon it for life. How does the prognosis of thrombosis compare with that of hemorrhage? While at first sight an attack of thrombotic apoplexy, with its preservation of consciousness and absence of stormy features, appears less harmful than one of hemorrhage, the facts are otherwise. The prognosis for recovery from paralysis is not as favorable in thrombosis as it often is in hemorrhage. One reason is that the damage to the arteries in thrombosis is more widespread than in hemorrhage. One attack of the former is usually a signal for the recurrence of numerous attacks, while in hemorrhage there may not be any recurrences during a lifetime. For a number of years I have had under observation cases in which only a single attack has taken place; one of these patients had his stroke thirty years before. He finally died of old age at 75.

Differential Diagnosis.—It is always well to remember that thrombosis is the blocking of a vessel with disturbances in the brain centers resulting from lack of blood. Further, that symptoms are produced slowly, for clotting does not take place suddenly, time being required to complete the process. We consequently have a train of symptoms preceding the attack, which may be transient sensory losses, paresthesia, or slight recurring motor palsies. In apoplexy due to hemorrhage, on the other hand, the torn blood-vessel permits the heart to pump blood into the brain 72 times per minute; the mass of blood accumulating in the brain causes pressure symptoms almost immediately after the stroke. We only mention convulsions, respiratory disturbances from pressure upon the medulla, Cheyne-Stokes respiration, convulsive twitchings, and, the most important differential symptom, the sudden loss of consciousness.

A case of apoplexy occurring in the young or in an individual under forty-five years is mostly thrombosis due to syphilitic arterial plugging. Most *old* people, when struck with apoplexy, suffer from thrombosis. Hemorrhage, on the other hand, occurs with greatest frequency between the ages of forty-five and sixty-five. When called to see an apoplectic patient under forty-five or over seventy years old, the probable diagnosis of cerebral thrombosis can be safely made.

Thrombosis must also be differentiated from embolism. The em-

bolic attack usually occurs suddenly and resembles in its onset hemorrhage more than thrombosis. Further, the patient affected with embolic apoplexy must have the conditions requisite to produce arterial plugs: an endocardial lesion, aneurysm, or floating clumps of organisms circulating in his blood.

Treatment.—While in hemorrhage the treatment aims to retard circulation, lower arterial tension, and to favor coagulation at the bleeding point, in thrombosis we wish to bring about opposite conditions. Here we endeavor to stimulate the heart, raise arterial tension, and accelerate the circulation, so as to lessen the tendency to further coagulation. When the patient is found in a state of syncope, means must be taken to revive the heart's action as speedily as possible. For this purpose nothing is better than hot-water bottles applied to the precordial region. Equally important is postural treatment: head low and feet elevated. When consciousness returns, the head and shoulders may be slightly raised, while the bed is lowered. Internally, stimulants must be given, but not too freely, for excessive heart action may cause rupture of a weakened vessel and add hemorrhage to an already existing thrombosis.

Personally I prefer to give 1 or 2 tablespoonfuls of brandy internally, and to apply ammonia to the nostrils. This is usually sufficient to revive the patient without overstimulating him.

While in hemorrhage we employ purgatives, salines, and other remedies to deplete the circulation away from the brain, in thrombosis we desire to send as much blood as possible into the brain, and must beware of cathartics. These not only cause the reverse of what is intended, but in addition create an increased coagulability of the blood. After the shock has passed off we may use cardiac stimulants, such as strychnia, digitalis, strophanthus, and brandy.[1]

In order to prevent constriction in the arterioles of the brain, we add small doses, say 1/100 gr., of nitroglycerin to each dose of digitalis or strophanthus. Formerly the arterial dilators, nitroglycerin and sodium nitrite, alone, enjoyed great popularity in the treatment of cerebral thrombosis. We now know that the vasodilators cause a lowering of the systemic blood-pressure; consequently they are given almost always in combination with cardiac stimulants.

The treatment of cerebral thrombosis from syphilitic endarteritis is identical with that of syphilis in general. The disappointment which so often follows the faithful application of antispecific remedies to thrombotic cases is due to a non-appreciation of the fact that blocking of a vessel causes irreparable damage to the brain, regardless of the cause that produced it. No amount of antisyphilitic treatment is capable of reviving

[1] Strychnia is not a cardiac stimulant, but it is very valuable in this condition, as it contracts blood-vessels, notably those of the splanchnic area, and this is followed by increased blood-pressure.—Editor.

a portion of brain which has remained bloodless for twenty-four or more hours. Only in the cases in which thrombosis is incomplete, or where a collateral circulation can be established, may recovery take place. Nevertheless, it is our duty in every case of luetic endarteritis causing thrombosis to make use of the most rigid specific treatment—preferably by hypodermic injection of gr. ⅛ (0.008 gm.) of corrosive sublimate into the gluteal muscles twice daily, or succinamid of mercury in the same doses. In addition arsphenamin or neo-arsphenamin in average doses, say 0.6 gm., may be injected intravenously once weekly. Six of these injections may be considered a course of treatment. Then all treatment should cease for a period of six weeks. At the end of that period another course of treatment, consisting of weekly arsphenamine injections and biweekly mercurial injections may be resumed, again followed by a period of rest. Later, and for many years, the mixed antisyphilitic treatment is to be administered during a period of at least three months out of each year.

I have stated that coma and loss of consciousness are not frequent in thrombosis. However, when the artery which becomes the seat of thrombosis is large or supplies the medulla, it is possible to have coma and interference with the respiratory centers. This is a condition analogous to that which is observed in hemorrhage, but the treatment differs radically from that of hemorrhage. In thrombosis we must stimulate the circulation so as to send blood into the brain, whereas in hemorrhage we wish to empty the brain of its bloody contents.

In many cases of thrombosis, after the attack has passed off, patients complain of intense headache, which is probably caused by the inflammatory reaction in the vicinity of the softened area. The treatment is: cold affusions to the head, leeches to the temples, and, if necessary, the coal-tar products: antipyrin, phenacetin, aspirin, and salophen, in ordinary doses. If convulsions or delirium appear during the reaction, these measures do not suffice. 30-gr. doses (2 gm.) of sodium bromid, in combination with 5 gr. (0.30 gm.) of chloral or 2 gr. (0.12 gm.) of sodium luminal may be given every four hours until an effect is produced.

The subjects of thrombosis are usually debilitated, worn-out individuals and require nutritious and easily assimilable food. In addition to meat and a liberal diet, small doses of alcohol and stimulating hot broths may be allowed. The stomach, bowels, and bladder all require constant attention on the part of the medical attendant.

The paralyses resulting from thrombosis demand special treatment, and are identical with those from hemorrhage. The after-treatment of hemiplegia is the same in all cases, regardless of the cause which produced it. I shall discuss the treatment of the contractures resulting from the hemiplegic state at the conclusion of the section on infantile cerebral palsy.

CEREBRAL EMBOLISM

Etiology.—The most frequent cause of cerebral embolism is acute or chronic endocarditis, principally at the mitral valve. Fibrinous deposits, fresh or old, are there formed, become dislodged, and are swept into the general circulation, reaching the brain. Another factor in the production of cerebral embolism is aneurysm of the ascending arch of the aorta, in which clotting and fibrin formation have taken place. From here fragments may be loosened and swept into the blood current, eventually reaching the terminal or end arteries of the brain. It is also possible for bacterial clumps to block arterioles and thus to cause embolus. Likewise, conglomerations of pigment masses from the destruction of the hemoglobin in malaria may plug a small cerebral vessel and produce the symptom-complex of cerebral embolism. Particles from infected material or fragments of tumor masses, that may have gained entrance into the circulation, may cause either simple or infected cerebral embolism and thrombosis.

The young are more frequently affected than the old, because rheumatism and endocarditis, the two common antecedent factors, are more prevalent in young individuals. In them also the circulation is more active, permitting fragments to be readily swept into the general blood stream. It must be stated, however, that no age is exempt from the development of cerebral embolism.

Symptoms.—From the very nature of the etiology we expect symptoms to begin suddenly. While consciousness is rarely lost—contrary to cerebral hemorrhage—the onset here is abrupt, thus differing from cerebral thrombosis, with its gradual onset and premonitory signs and warnings. In embolism there may be slight twitchings, but rarely convulsions, as in hemorrhage. Neither slight vascular forebodings nor symptoms of cerebral hyperemia and congestion precede embolic plugging. In embolism paralysis develops suddenly, within a few minutes, usually on the right side, and in combination with aphasia. The left side of the brain is commonly selected by the lesion, because it is easier for a plug to reach the brain through the left common carotid—almost a direct continuation of the aorta—than through the right artery, which is a branch of the innominate.

Aside from the difference in onset the permanent symptoms, and even the pathological anatomy of cerebral embolism, are similar to those which have been described in connection with thrombosis. The most common and important symptom is the development of hemiplegia, with or without aphasia, depending upon the localization of the embolus.

Prognosis.—The prospects for recovery are far better in cerebral embolism than in hemorrhage and thrombosis. The patient, being often a young individual with elastic arteries, is not incapable of establishing a collateral circulation. This is not the case in thrombosis, which affects persons with extensive arterial hardening of a kind which does not admit of dilatation for furnishing the anemic brain with nutriment. It must be emphasized, however, that, if recovery in embolism is to occur at all, it must take place soon, for when a portion of brain tissue has been deprived of its blood supply for a few days only, the resulting hemiplegia will be as permanent as in thrombosis and hemorrhage.

Pathology.—The pathological changes resulting from sudden plugging of a cerebral artery by an embolus are almost identical with those occurring in gradual clotting within the blood-vessels. There is at first acute softening with subsequent cicatrization, and, in late cases, cystic formation.

Differential Diagnosis.—Embolism is to be differentiated from hemorrhage and thrombosis. We shall take up hemorrhage first. Embolism and hemorrhage both develop suddenly. In embolism, however, there are no premonitory symptoms of cerebral mischief, and the attack is usually not accompanied by convulsions. The patient has suffered from rheumatism and endocarditis of the mitral valve, or is the subject of aortic aneurysm. In any case the diagnosis of embolism is never certain unless the source of emboli can also be ascertained, namely, endocardial disease or aneurysm.

Between embolism and thrombosis there will seldom be difficulties in differentiation, for the latter is usually preceded by symptoms of vascular disease. There has probably been a similar, milder attack, which culminated in a series of slight motor or sensory disturbances. In a young man there may be a history or signs of syphilis. If the attack occurs in a man after sixty-five, with atheromatous degeneration of the arteries, it is probably thrombosis. It is possible for an embolus to become the starting point of a thrombus, and we may then have what is called an embolic thrombosis. In the cases in which there is coexisting heart disease, with low blood-pressure and arterial degeneration, the diagnosis between thrombosis and embolism may remain doubtful. The development of a "stroke" during excitement speaks for the diagnosis of embolism, as the latter requires a quickened circulation, while thrombosis is usually accompanied by slow heart action.

Treatment.—In embolism it is necessary that the patient be absolutely quiet. An irregular and feebly functionating heart invariably shows a tendency to permit the deposition of fibrin upon the valves, and an over-excited heart washes the fibrin into the general circulation.

As a heart stimulant I prefer strychnia sulphate in doses of gr. 1/20

(0.003 gm.) every four hours. Occasionally I order tincture of digitalis in doses of 5 drops (0.3 c.c.) every three hours, provided I can watch the patient.[2]

Of course, no hope can be entertained that any amount of treatment will either dissolve or dislodge an embolus. The utmost to be expected is some success in minimizing the amount of thrombosis which often succeeds the embolus. Cardiac tonics are also indicated in all those debilitated states of the heart which allow clots to form within it, as, for instance, in severe cases of typhoid fever and other conditions accompanied by low blood-pressure and grave anemia. When the embolus blocking a cerebral artery has originated in a septic source, the prognosis is exceedingly unfavorable. Strenuous treatment will have to be directed not only against the focus in the brain, but also against the original source of infection. From septic emboli solitary or multiple abscesses may form in the brain. The treatment of the end results of cerebral embolus—softening and cicatrization—is the same as in thrombosis.

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CHAPTER XV

ENCEPHALITIS

(*Acute Non-purulent Form*)

JULIUS GRINKER

Introduction.—The brain tissues, like other organs in the body, are subject to inflammation, which may be acute or chronic, localized or general. Both parenchyma and interstitial tissue may be affected, either alone or in combination. Localized forms of acute encephalitis may occur in connection with meningitis, or follow thrombosis and hemorrhage. Cerebral inflammation in patches may also take place near a tumor, an abscess, or an accumulation of fluid, as in hydrocephalus. Of great importance are the inflammations secondary to acute infectious processes in the vicinity of the cerebral cortex. Perhaps the gravest type of this disease is the variety which occurs in the wake of an acute general infection. In accordance with the best custom, we shall take up the disease under the following subheadings: (1) acute hemorrhagic encephalitis; (2) acute hemorrhagic superior poliencephalitis; (3) acute hemorrhagic inferior poliencephalitis.

ACUTE HEMORRHAGIC ENCEPHALITIS [1]

The disease is mostly always caused by infection. It has been seen in influenza, measles, scarlet fever, pneumonia, whooping-cough, and after diphtheria. Inflammation of the brain substance may also be caused by contusion of the brain.

Symptoms.—The disease selects with preference children and young adults. The onset is usually stormy, with headache, vertigo, depression, or irritability. The patient becomes stuporous, semiconscious, and rapidly merges into a comalike state. Though superficially resembling apoplexy, the coma is rarely profound, and there are no pupillary changes. Instead of a fall there is an immediate rise of temperature, slight at

[1] The epidemic form is treated under the Infectious Diseases.—Editor.

first, but it may become quite high. Paralytic symptoms are not in evidence early, but these usually come on later. In the beginning of an attack stiffness of the neck may appear, rarely general convulsions. There are restlessness, delirium, and stupor. Respiration and pulse are both accelerated; there may be Cheyne-Stokes respiration and slow pulse. In the severe cases symptoms quickly become aggravated and the patient dies in coma twenty-four or seventy-two hours after the onset of the disease. In other instances the course may be protracted, and yet the case terminates fatally even after twenty or more days. If the inflammation is localized in the convexity of the brain over motor areas, we may have epilepsy; if the occipital lobe is affected, hemianopia may be the result. At the base of the brain encephalitis may cause optic neuritis and other cranial nerve lesions. In those cases in which cerebellar symptoms predominate there are hemiataxia, nystagmus, and rapidly developing optic neuritis. When pons, medulla oblongata, or cerebellum is affected, the symptoms are sufficiently distinctive to direct attention to these localities. Encephalitis affecting exclusively the pontine-bulbar structures is usually described as poliencephalitis inferior.

Pathology.—The acute inflammation has a hemorrhagic character. The affected parts appear hyperemic and swollen, and seem studded with numerous spots resembling flea-bites. Macroscopially, in recent cases, we have the ordinary appearances of inflammation: dilated capillaries and infiltration of leukocytes. In cases that have lasted some time there are found granule cells and extensive proliferation of glial tissue.

Diagnosis.—This is extremely difficult and should, therefore, be made with caution. The symptoms resemble acute serous meningitis, sinus thrombosis, and acute meningitis after infectious diseases. In general it may be said that encephalitis differs from all these affections in the fact that focal signs usually appear early and remain leading symptoms.

Prognosis.—This is extremely grave. When a case develops rapidly with loss of consciousness and high fever, the course is usually a fatal one. On the other hand, certain cases announce quite early that recovery is impending; the stormy symptoms gradually subside and a prolonged convalescence begins, lasting for weeks, months, and even years. Recovery with defect may occur; in fact, this is the rule in the Strümpell type of infantile cerebral palsy.

Treatment.—The treatment is purely symptomatic. The patient should be placed in bed and given a quiet environment, as noises and bright lights are harmful. Emotional excitement of any kind should be strictly avoided. Of great value are cold applications or an ice-bag to the head; venesection and leeches are to be used early in the sthenic cases. For the fever, if present, we administer antipyretics, but rely principally on cold douching. The bowels should not be neglected. In lingering cases we employ hydrotherapy and electricity. The after-treat-

ment of paralysis is identical with that which results from cerebral hemorrhage, thrombosis, and embolism.

ACUTE HEMORRHAGIC POLIENCEPHALITIS

Acute Hemorrhagic Superior Poliencephalitis

In 1881 Wernicke first described this type of encephalitis as occurring mostly in whisky or brandy drinkers, and in some other forms of intoxication. At intervals these patients may have suffered from the symptoms of chronic alcoholism—gastric catarrh, morning vomiting, pains and cramps in the calves of the legs, headaches, amblyopia, weakness and uncertainty in the lower extremities, as well as delirium tremens. Then prodromata appear, such as headache, backache, limbache, vertigo, and vomiting—and perhaps even delirium. Shortly afterward the disease itself appears with acute onset.

The principal symptoms begin either with delirium tremens, or set in suddenly with paralysis. There are states of confusions, restlessness, general trembling and sweating, hallucinations, picking at the bedclothes, or there are the trembling and busy delirium of alcoholics. In addition there may be fever and general weakness. The confusion and motor unrest may have been ascribed entirely to the alcoholism, but throughout the disease delirium is a prominent symptom and a stuporous state becomes more and more noticeable. In some cases the mental condition resembles that of Korsakoff's psychosis. In the cases which are caused by other than alcoholic poisons somnolence appears early. Perhaps the most important symptom of this variety is the appearance either immediately at the onset, or within a few days of it, of complete *ophthalmoplegia.* The ocular paralysis may have been preceded by pupillary inequalities, ptosis, or nystagmoid jerkings of the eyeballs. Another striking symptom, denoting cerebellar trouble, is that the patient's gait becomes peculiar; he walks with feet wide apart and reels from side to side, presenting typical cerebellar ataxia. In most cases muscular weakness is pronounced in the upper and lower extremities. Tremors, like those seen in delirium tremens, and also choreiform movements are often noticed. In addition hemiparesis or hemiplegia may appear; also sphincter paralysis. The tendon reflexes vary; they may be normal, reduced, or exaggerated. In cases with hemiplegia we commonly see clonus and Babinski sign. Dysarthria is a symptom when the pontine and medullary centers are affected. Rarely ophthalmoplegia is seen in association with facial paralysis. The temperature is either normal or subnormal; the pulse is almost always rapid; 80, 100, and even 140 or more beats

to the minute have been counted. The course of the disease is either acute or subacute. Death may occur within a few days or after weeks.

Acute Hemorrhagic Inferior Poliencephalitis

This is a subdivision of the preceding type, which differs from it in that the gray nuclei of the medulla are mostly or extensively involved. From these nuclei the disease usually extends either upward toward the brain, or downward toward the spinal cord; or there may be only diffuse inflammation of the pons and medulla. The last condition is called acute poliencephalitis inferior or acute bulbar myelitis. While in acute superior encephalitis the ophthalmoplegia is the prominent symptom, in this form—acute inferior poliencephalitis—*bulbar symptoms* predominate. It is the type of poliencephalitis which has recently been observed by Wickman and others in epidemics of poliomyelitis. It was Medin, however, who first saw the true relation between certain isolated cranial nerve lesions and infantile spinal paralysis. Oppenheim promptly acknowledged it, and was one of the first to write on it, so that at present the relation between acute poliomyelitis and poliencephalitis interior is generally recognized. In the report of the Collective Investigation Committee on the New York epidemic of 1907 we find it mentioned that bulbar forms have been observed among the very acute cases (formes frustes) and in several of the fatal cases. The reporters say:

"When the infectious process has been most intense it has been extended into the medulla oblongata and the pons, possibly even to the floor of the third ventricle. . . . Polioencephalitis, then, is an acute infectious process similar to poliomyelitis, of which it may be a part."

From the point of view of early diagnosis and correct therapy, it is well to bear this in mind when examining a case of poliencephalitis. By prophylactic measures we may possibly avert an attack of poliomyelitis. While the pontine structures, in which the facial nerve originates, are principally affected, the hypoglossal can also become the seat of inflammation. When pons, medulla, and spinal cord are simultaneously involved, we speak of poliencephalomyelitis.

What follows applies equally to the superior and inferior types of hemorrhagic poliencephalitis.

Prognosis.—There are acute and subacute forms. The acute type generally terminates fatally in from eight to fourteen days, while the subacute variety may pass through a protracted course and not rarely terminates in recovery.

Pathology.—There is a hemorrhagic, inflammatory process, similar in appearance to the one described in the first type of encephalitis. The in-

flammation is confined principally to the gray matter of the third ventricle and the aqueduct of Sylvius, and may even extend to the fourth ventricle. The process does not limit itself to the gray; white and gray matter may be alike implicated. When the anterior horns of the spinal cord have become part of the disease, as occasionally happens, pathological changes are found in the spinal gray in addition to those of the pons and medulla.

Diagnosis.—For this we consider principally: the onset, which is acute or subacute; the development of focal symptoms, which are mostly phenomena of ophthalmoplegia or bulbar paralysis, or both, combined in various groupings. We also take into account the fact that the disease has a descending course, although the opposite may take place, and that, if the disease be poliencephalomyelitis, it is more or less diffusely distributed over brain and cord. The cranial nerve symptoms yield the clinical syndromes of ophthalmoplegia and glossolabiolaryngopharyngeal paralysis, while the typical spinal disease is a diffuse or circumscribed atrophic cord paralysis. Sometimes cord symptoms predominate over bulbar symptoms; at other times the reverse is the case. The diagnosis should only be made after due deliberation, having regard for all the circumstances attending the development of each case and paying particular attention to the onset, which is that of an acute infection. Compare this description with that given of encephalitis lethargica, and both similarities and dissimilarities will be noted.

Treatment.—As the disease has alcoholic or other intoxications and infections for its cause, we aim first to prevent the further intake of alcohol and of other deleterious substances, and, secondly, to act upon the emunctories so as to cause the excretion of poisonous products from the body. Early in the disease the usual remedies utilized in the treatment of other forms of inflammation are in order. Of these the most important are the various applications of cold to the body, such as ice to the head, general cold water bathing, sponging, etc. As there is a hemorrhagic inflammation present, the remedies advised in the treatment of cerebral hemorrhage also appear to be indicated. It is essential that the patient receive no stimulants of any kind. He should be in bed and avoid all excitement and mental stress. The diet should be nutritious, but non-stimulating. Particular attention must be paid to the possible development of complications. Decubitus may be anticipated by strict cleanliness and the best possible personal hygiene. Bowels and bladder must not be neglected. When hyperemia or congestion are pronounced features, blood should be withdrawn by venesection, and laxatives administered in the manner previously outlined. On general principles, and for the same reasons that they are administered in serous meningitis, iodid of potash and mercurial inunctions have been given. When fever is high the usual antipyretic remedies are cautiously prescribed. For extreme motor excitement, morphin hypodermically, chloral hydrate

internally or by enema, and luminal are administered. Hydrotherapeutic measures are helpful to allay the irritability of the nervous system besides reducing the temperature. A good plan is to interchange moderately cold general baths with hot foot-baths. Sinapisms to the neck, chest, and extremities may be tried. Lumbar puncture has been made use of therapeutically in numerous cases. The results achieved do not warrant its further therapeutic continuance in this malady. When the acute disease has become chronic, the remaining paralyses are treated by means of electricity, massage, and orthopedic measures. For the treatment of the poliomyelitic variety the chapter on Acute Anterior Poliomyelitis should be consulted.

THE CEREBRAL PALSIES OF CHILDREN

(*Infantile Cerebral Paralysis*)

The paralyses of cerebral origin occurring in childhood may be divided into three groups: (1) paralysis due to conditions arising before birth; (2) those following birth accidents; and (3) palsies dependent upon disease or trauma after birth. They may also be conveniently discussed as (1) the hemiplegic, (2) the diplegic types.

Etiology.—The *prenatal* cases often show deficiency of brain elements —so-called agenesis. Either a portion or all of one hemisphere has been found absent or atrophic. In these cases is seen the peculiar condition of porencephaly, that is, a direct communication between cortex and ventricles, owing to shrinking of the intervening portion, the result of antecedent disease. In other instances there is a lack of physical and mental endurance, capacity for growth is arrested, and the brain succumbs early, having no powers of resistance. In some of these cases the pyramidal tracts have not developed. Even normally the upper motor neuron is formed as late as the ninth intra-uterine month, and is not entirely developed until two or three months after birth. In these unfortunates the neuron is probably never finished. Traumatism to the brain of the unborn child very rarely occurs. Hemorrhage or softening has taken place in some cases; in others a meningo-encephalitis was the cause. It is admitted by some and denied by others that inherited syphilis lies at the foundation of many cases of cerebral palsy. Illness of the mother during pregnancy has also been made responsible for the causation of cerebral palsy in the offspring.

The majority of cerebral palsies occurring *at birth* are due to difficulties attending the expulsion of the head from the parturient canal. Quite frequently a history of forceps delivery or of protracted labor is the only etiology given. In these cases hemorrhages have undoubtedly oc-

curred in the membranes. The forceps are not always the cause of bleeding; on the contrary, sometimes their timely application has prevented hemorrhage and cerebral palsy. It is hemorrhage in the membranes which causes the largest number of cases of asphyxia of the newborn and stillborn children. From the same cause convulsions and even death may occur soon after birth. If the child survives, the probabilities are that there will be either a hemiplegia or a diplegia later.

Of cerebral palsy following disease or trauma *after birth,* we may mention the vascular lesions, which are also found in adults, such as hemorrhage, thrombosis, and embolism. An additional cause which has of late been prominently brought forward is encephalitis. Strümpell claims that cortical poliencephalitis is the lesion in many of the observed cases. Cerebral venous thrombosis has also given rise to infantile cerebral palsies. It is often a part of a spinal thrombosis, which either precedes or succeeds it. Similar to arterial vascular disease, venous thrombosis may produce softening or sclerotic changes in the motor cortex, with palsy as a result.

Symptoms.—The disabilities following cerebral palsy are not always observed soon after birth, even if the palsy has occurred before or at birth. However, birth palsies are usually noticeable shortly after birth or within a few weeks of it. In the acquired cases the patients appear well up to the development of paralytic phenomena. When first seen some years after birth there is nothing pathognomonic in the appearance of the disease pictures indicative to which category a given case belongs. Possibly the observation that most natal and prenatal cases have been bilateral palsies may aid in diagnosis. The tendency after birth is toward a unilateral paralysis.

The Hemiplegic Type.—Most cases occur in children between the ages of three and six years. The onset is marked by fever, malaise, and convulsions, with more or less disturbance of consciousness. Some time after a convulsion it was noticed, perhaps, that there remained a weakness on one side, more pronounced in the upper extremity. In some cases the motor cranial nerves are also affected. After some time power in the paralyzed extremities may gradually return, but in the great majority of cases much paralysis remains. The preceding symptoms may be classed as early ones. Later symptoms are epileptic fits, mental deterioration, perhaps athetosis, and choreiform movements. When the lesion has occurred in the left hemisphere, aphasia may result. Fortunately children almost always recover speech more or less perfectly, for the right half of the brain appears to act compensatorily. In the hemiplegic cases the arms usually recover less than the legs or face, and the athetoid condition present is mostly confined to the arms.

Cerebral Diplegia.—This form is characterized by a spastic condition accompanied by variable degrees of weakness on *both sides* of the body.

In addition to rigidity and weakness there are involuntary movements, but mental deficit here is not the rule. The cases, however, differ widely one from another. In a typical case of cerebral diplegia the movements of the extremities are not as free as they should be. The limbs appear spastic and clumsy. When carefully examined, increased knee-jerks and accentuated Achilles reflexes are found, and, if the child be old enough—over one year—a Babinski sign may also be present. The rigidity in most cases is out of proportion to the weakness. In attempts at walking the attitude is of the well-known "scissors-legged" type, owing to spasm of the adductors of the thigh. The arms and face may also be affected. The weakness, always present in some degree, is often masked by the rigidity, which makes voluntary movements more difficult than they would otherwise be. The before-mentioned involuntary movements occur in a considerable number of cases, and often attack the hand and arm, less commonly the leg and face, taking the form known as athetosis, the chief characteristics of which are slow, more or less rhythmical, involuntary movements of the fingers and thumbs, in which hyperextension is a prominent feature. Sometimes either one or both arms participate in movements which may be so violent and uncontrollable as to necessitate strapping the limb to the side. All degrees of mental impairment are met with, from mere backwardness to complete idiocy. Quite frequently there is impaired articulation. Not the least serious symptom is epileptic fits, which are commonly associated with cerebral palsy.

The less severe cases of cerebral diplegia, in which symptoms are confined principally to legs that are rigid and slightly weaker than normal, are usually classed under *Little's disease,* because Little was the first to describe this type. He had in mind cases that are born prematurely and suffer from non-development of the motor tracts, particularly of those for the lower extremities. Such patients may show no mental defects whatever, nor epilepsy; are as a rule undersized, and never learn to walk properly. These patients may have a spastic gait all their lives, but, as their intellect is not often affected, many become useful members of society.

Diagnosis.—The diagnosis is usually not difficulty. In those instances in which epilepsy is the prominent symptom, and the evidences of organic disease are insignificant, one may overlook the cerebral palsy and diagnose the cases as essential epilepsy. Careful search, however, will discover slight differences on one side, or there may be bilateral spasticity or clumsiness in locomotion. The admonition cannot, therefore, be urged too strongly that every case of epilepsy in a child should be most carefully searched for evidences of organic cerebral disease.

Prognosis.—The prospects in the cerebral palsies are not good for complete recovery of motor power and intelligence. In the majority of cases some permanent defect is left. The outlook in the congenital

cases becomes better the earlier improvement in motion and in intelligence have been noted. In such instances there may be only partial paralysis and little or no mental impairment. In the great bulk of cases, however, there are not only mental retardation, but also idiocy, imbecility, and epilepsy. Most epileptic idiots are of this variety. Cases of Little's disease are among the most hopeful. In these mentality may not be at all impaired and improvement in motion is possible. In the birth palsies the number and intensity of the early convulsions and also their persistence form a rough guide to the prognosis as to life. When slight motion appears in the extremities some months after birth, we may expect still more improvement. There are no criteria to determine what the mental development will eventually be in each individual case. In the cerebral palsies acquired after birth, as a result of disease, the prognosis is much the same as in the cerebral accidents of adults that eventuate in paralysis. One hopeful feature usually not found in the adult is that in cases of aphasia there is, as a rule, return of speech. The prognosis for recovery becomes all the more gloomy when epilepsy persists or is followed by dementia.

Prophylaxis.—Under this heading little is to be said. In the interest of the child every pregnant mother should maintain her nutrition to the utmost. The most rigid hygiene should be followed by the mother so as to benefit the unborn infant. In the case of syphilis of the mother a vigorous course of specific treatment is indicated in order, if poossible, to avert trouble in the offspring.

When the infant itself is syphilitic no time should be lost; the little patient must be treated according to the best rules. These cases often do well under treatment, and in many instances the disease has been entirely arrested.

Regarding the birth palsies which are the result of protracted labors, or have been caused by the injudicious application of forceps, physicians are cautioned that it is just as unwise to wait too long for an unaided delivery to occur as it is to apply forceps in every case.

Treatment of the Acute Stage.—The principles of treatment of the apoplectic insult, whether from hemorrhage, thrombosis, or embolism, are the same as for adults. As a rule, the pathological cause of the attack in children is not thrombosis, but hemorrhage, and the treatment should be carried out accordingly. Rest, ice-cold applications, leeches, derivative remedies to the intestinal tract, and stimulation of the skin are the most important measures. For repeated convulsions the inhalation of chloroform may become necessary.[2] When epileptiform attacks continue to recur, a systematic course of luminal must be instituted. Should the initial stages become protracted and resemble meningitis, treatment will be carried out the same as in meningitis. The after-treatment of an

[2] Rectal injections of chloral are most valuable, especially in infants.—Editor.

apoplectic insult requires the same degree of care as hemorrhage in the adult.

Paralytic State.—Paralysis is treated on approved lines of therapy. Choreic disturbances are the result of a progressively advancing chronic irritation of the motor tracts. Though we know of no remedy capable of arresting the progress of choreiform movements, nevertheless we can attempt to remove all injurious influences that may aggravate them. Careful mental hygienic training must be attempted under sensible direction. The child must be enjoined to put forth an effort to inhibit the abnormal movements. For this purpose massage and gymnastics calculated to teach the patient control of his movements are also indicated.

Intellectual defects are often unnoticed until the child begins to develop physically. At a time when children should speak, it may be noticed that they are aphasic or show mental deficit. The aphasia, as has already been stated, is never complete. A certain amount of improvement, even in bad cases, occurs. But much patience is required in teaching the little ones how to acquire speech. After some labor, in the majority of cases, one is rewarded by seeing improvement. Epilepsy is quite common in cerebral palsy; it is a symptom requiring our earnest attention, as the epilepsy itself prevents to a large degree the child's mental development.

Regarding the treatment of epilepsy in these cases, we are no longer dependent on the bromids, a remedy which often did more harm than good. In luminal and sodium luminal (phenobarbital and sodium phenobarbital) we have an excellent remedy for epileptiform convulsions. The effect on the seizures has been, either to affect favorably their intensity and frequency or to cause complete subsidence of attacks. In addition, and as a direct consequence of treatment, the patient's mentality improves. An undeveloped brain not exposed to numerous stormy episodes is more likely to reach its highest development than one subjected to frequent epileptic attacks. Though not specifics in any sense of the word, luminal and its soluble sodium salt have become the most effective antiepileptic remedies at our disposal, and deserve a trial in every case of cerebral palsy accompanied by epilepsy. The usual dose for children from five to ten years old is 1 gr. (0.06 gm.) once or twice daily. For correct dosage, indications and contra-indications of these remedies the reader is referred to the writer's two papers on this subject mentioned in the references of this article.

Surgical Treatment.—In infantile cerebral palsy operations on the brain may be undertaken in selected cases. Patients have been operated for epilepsy, chorea, and athetosis. In some of these there has been an improvement in the convulsions immediately after the operation. This improvement has lasted at times six and at other times twelve months.

In my experience the attacks have almost invariably returned. In some

cases the operation itself was fatal. With E. D. Henschen I now advise operation in cerebral palsy, but only when undertaken within the first few months or years after the development of epileptic attacks following cerebral palsy. I advise operation, particularly when focal signs of some kind are present. Certainly, if hemiplegia or monoplegia indicates the side of the lesion and the epileptic manifestations always begin in one extremity, the indication for operation is clear.

For the remote effects of paralysis, namely, late contractures with inability to walk owing to the spasticity, a new method of treatment has recently been devised by Otfried Förster. The treatment has been tried in a number of cases with remarkable results. Reports from various operators, both here and abroad, are very encouraging, and prompt a continuance of the method. From physiologic reasoning, backed by experiments on animals, Förster concludes that, when the reflex arc in the cord is broken, spasticity—itself an expression of exaggerated reflex activity—must be either reduced or abolished. Further, his past experience has taught him that, whenever to a pyramidal tract lesion there was added posterior cord or root degeneration, existing contractures disappeared. It was by considerations such as these that he was led to devise the operation, which aims to abolish spasticity and contractures by cutting the posterior roots at their exit from the cord. As, according to Sherrington, the sensory root zones overlap from above and below, he advises not to cut two contiguous roots, but to leave intact one or two between each cut root. This he believes to be sufficient to prevent anesthesia. He recommends the operation for the intractable contractures which hinder locomotion, and also for the painful crises from such contractures occurring in Little's disease, congenital spastic paralysis, compression myelitis, and multiple sclerosis. He insists that only the serious cases should be operated on, and especially those in which spasticity predominates over paralysis. In his opinion it is absolutely necessary to cut at least four roots. In the lower extremities he advises resection of the second, third, and fifth lumbar roots and of the second sacral root. In mild cases only three roots are to be cut. In the upper extremities he recommends cutting the fifth, sixth, and eighth cervical and first dorsal roots, or the fourth, fifth, and eighth cervical roots. In cases of so-called contracture crises, in which from time to time the paralyzed lower extremities draw up on the trunk with such violence that the pain is almost unbearable, Förster's operation is the only means of giving relief. His technic is as follows: Free the dura by removal of the arches of the second to the fifth lumbar vertebra and of the upper part of the posterior wall of the sacral canal. In order to work with ease the dura should be exposed for at least 2 cm. transversely and be split in the center from below upward. The cauda equina is now completely exposed. As a reliable landmark he gives the fifth lumbar spine, the first sacral root having its

foramen of exit on the inner surface of the dural sac opposite this spine. Before removal of any of the vertebral arches, he suggests that a long nail be driven into the fifth lumbar vertebra, exactly 1½ cm. laterally from its spine. The nail remains to the end of the operation. When the dura is slightly pulled up at this level one can see the point of exit of the first sacral root. Begin with the second sacral root. Before cutting separate the anterior from the posterior root—the posterior root is recognized by being much larger than the anterior. After having cut the second sacral, proceed to section the fifth lumbar, and, lastly, the third and second lumbar roots. The operation is performed in two stages, on account of the field of operation usually becoming obscured by the accumulation of blood when the dura is opened. Sectioning of the roots can be done several days later. Reports from our busy surgical centers seem to confirm the favorable statistics reaching us from Europe. Regarding the permanency of results, that is, how long the muscles will remain relaxed, the operation is too new to furnish definite data for positive conclusions. It is not to be inferred that the mere cutting of sensory nerve roots is sufficient to restore motion in the parts. The operation constitutes only the first step in a long process of treatment by means of gymnastics, calisthenics, massage, and electricity. The after-treatment is calculated to develop those muscles which have hitherto been unable to functionate because of spasticity and contractures.

Förster's operation requires great skill and should be undertaken only after other measures have failed.

Another advance in the treatment of athetosis and spasticity of muscles incident to infantile cerebral palsy has been inaugurated by Sidney I. Schwab and Nathaniel Allison, both of St. Louis. They published their first article in the *Journal of Nervous and Mental Diseases* for August, 1909, under the caption: "The Surgical Treatment of Athetosis and Spasticities by Muscle Group Isolation." After reviewing the various measures advised for the correction of muscle contractures and spasticity, they come to the conclusion that the isolation of muscles and nerves by means of various strengths of alcohol is preferable to any of the methods in vogue at the present time. In their own words:

"We have been led to devise a method which we shall refer to as muscle group isolation. This implies the isolation of muscles or groups of muscles which are at fault in the production of contracture, deformity, or athetosis. It is made effective by cutting off from the central nervous system the connection along which the abnormal impulses, active in causing spasticity or athetosis, are transmitted. This is done by a direct attack upon the nerve itself by isolating it and injecting it with an alcoholic solution. There has resulted in the cases in which it was tried an immediate paralysis of the physiologically stronger groups of muscles,

without interfering with the free muscular use of the antagonists. At this point physiological exercises planned to further strengthen the antagonists may be used."

They continue:

"In the selection of a case on which to try this method for the first time, a simple case of athetosis in which the ulnar nerve is regarded as being primarily involved was chosen, for the reason that the operation would be neither difficult nor dangerous. Inasmuch as this case presented a median nerve complication, it was an easy matter to inject the median nerve at a later time. Our experience in this instance encouraged us to attempt a more complicated operation on a case in which the spasticity was both more general and more intense. Here the condition was bilateral adductor spasticity of the lower extremities in so-called Little's disease, requiring an isolation and an injection of the obturator nerve, which supplies the adductors of the thigh. This nerve descends through the inner fibers of the psoas muscle and emerges from its inner border near the brim of the pelvis. It then runs along the lateral walls of the pelvis above the obturator vessels to the upper part of the obturator foramen, where it enters the thigh and divides into an anterior and posterior branch, separated by some of the fibers of the obturator muscles, and lower down by the adductor brevis. For the purpose of this operation it was necessary to discover the nerve above this division into its branches, that being the necessary point for injection. The fact that this nerve is a motor nerve and supplies a most powerful muscle group, namely, the adductors of the thigh, the gracilis, pectineus, adductor longus, brevis, and magnus, and that this group is all-important in the production of cross-legged progression, made it a most favorable object for testing the value of this operation."

In the *American Journal of Orthopedic Surgery* for August, 1910, Nathaniel Allison, under the heading of "Muscle Group Isolation and Nerve Anastomosis in the Treatment of the Paralyses of the Extremities," again describes the technic for obturator nerve injections with alcohol. In addition, he points out the method of affording relief for overaction and spasticity of the hamstring muscle groups. For this he injects the nerves which supply the biceps, semimembranosus and semitendinosus muscles. These are branches from the trunk of the great sciatic nerve, given off in the upper half of the thigh. Further, he devised an operation for the relief of overaction of the gastrocnemius group. The muscles involved being the gastrocnemius and soleus, which are supplied by branches from the internal popliteal nerve, he injects the latter with alcohol. Lastly, he describes the operation of reaching the anterior tibial nerve, in order to place an injection of alcohol into it for the relief of

spasticity affecting the anterior tibial group of muscles. Any one who intends to perform these so-called "nerve-blocking" operations will find it necessary to read the original article, as the details of procedure are therein fully described.

In a discussion which took place before the Chicago Medical Society, during which Sidney Schwab and Nathaniel Allison had an opportunity to present an account of their alcohol injection method, while Frazier spoke of his results with posterior root section, it was brought out very forcibly that in some instances alcohol injections will be the choice, while in others the posterior root section operation must be selected. Neither of these methods can cause regeneration of nerve structures, or is capable of bringing about restoration of function. The underlying cause being degeneration or non-development of brain tissue, complete recovery is impossible; but great improvement has been noticed both as regards relief from painful contractures, as well as ability to use effectively the extremities. This improvement was the more remarkable, as some of the patients could not take a step before operation, but could get about without mechanical assistance afterward. My own experience with both these methods is limited, but the results I have already attained are sufficiently favorable to warrant further trials.

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CHAPTER XVI

CEREBRAL ABSCESS

JULIUS GRINKER

Introduction.—Brain abscess is a surgical affection and belongs especially to otology. The general practitioner, however, is usually the first to see the case in its early stages. Timely recognition enables proper treatment to be instituted and lives to be saved.

Etiology.—Abscess of the brain is either secondary to disease elsewhere, or it is due to infection from without. The microbe at work is commonly the Streptococcus pyogenes or the Staphylococcus pyogenes aureus; the Staphylococcus pyogenes albus has also been found. Other organisms, such as the pneumonia diplococcus, the Bacillus pyocyaneus, and the tubercle bacillus have been frequently observed in the contents of brain abscesses. The infectious source may be situated in a remote part of the body, or it is found in the immediate vicinity of the cranial cavity.

1. Of the remote infectious sources we mention the following: purulent depots in bronchi, lungs, pleura; ulcerative endocarditis; peritoneal infections and bone diseases leading to pyemia. The infectious material is often carried by the blood-stream and is capable of causing multiple purulent foci in the brain, constituting small or large abscesses.

2. Of the neighboring sources of infection purulent otitis media takes first place—it being responsible for more than one-half of all cases of brain abscess. Next in order comes suppuration of the scalp occurring after trauma; further, suppuration of the frontal and maxillary sinuses. It is not to be forgotten that carbuncles, pharyngeal ulcerations, or pus formation in the orbital or nasal cavities, as well as purulent meningitis, may serve to transmit microbes to the interior of the brain, causing abscess.

The infectious material may enter (1) through the lymph current by the sheaths of arteries, veins, and nerves, and through the lymph sacs and spaces from the connective tissues; (2) through the blood, by perforating veins, and disease of the bones with or without septic thrombi.

Brain abscesses caused by suppuration in the vicinity of the cerebrum

are usually found near the primary infection focus—a fact of great importance in treatment. Such an abscess is usually solitary, or single, and consequently quite operable. The brain abscess proper is often preceded by pachymeningitis externa, with or without extradural abscess. The dura itself is perforated either macroscopically or microscopically and adheres to the pia; it is here that the infectious material enters the brain from without.

Abscesses forming in connection with growths occasionally become encapsulated, but later the capsule breaks either in the direction of the ventricles or toward the surface of the brain.

Diagnosis.—The diagnosis of brain abscess is usually not difficult when a distinct source of infection is discoverable. The diagnosis must embrace the following points: (1) Is there an abscess? (2) Where is it situated? (3) Where does it originate?

From the point of view of treatment, the last is the most important question to answer, for it is not sufficient to treat the brain abscess—the primary seat of infection must also be cleared out, or there will be a recurrence. The diagnosis of cerebral abscess must be based upon the finding of (1) that there has been a trauma or other primary source of infection, and (2) that there exist the general signs and symptoms of cerebral abscess.

Symptoms.—The symptoms of cerebral abscess are usually vague and variable. In the *first stage* symptoms of the primary infection still predominate, but there are already signs of extension of the process to the brain itself. This may be indicated by the appearance of *headache, localized pain, vomiting, chills,* and *fever.*

In the *second stage* cerebral symptoms become more distinct. Pain seems to abate, owing to the apathetic condition of the patient; apparently the disease is less threatening, but the patient is becoming stuporous. The temperature is normal or subnormal. Respiration now becomes slow and the pulse is very much retarded, 50 to 60 per minute. Vomiting is not common in this stage, but it may be a symptom at this time. In addition there appears an optic neuritis which is usually not as intense as that of brain tumor. Finally the general signs of infection, such as chills and fever and extreme prostration, are seldom wanting.

In the *last stage,* with the increase in the size of the abscess, the patient grows more stuporous and even becomes comatose.

The localizing signs and symptoms depend entirely upon the situation of the abscess; whether it is developing in a motor, sensory, or a special sense area. Only general symptoms will appear when the abscess is in a so-called "silent" region of the brain. In a general way the localizing signs are similar to those of brain tumor.

From the point of view of treatment we may distinguish the following two principal kinds of cerebral abscess:

1. *Traumatic Abscesses.*—These usually form in the immediate neighborhood of a trauma and are considered purely surgical affections.

2. *Otitic Abscesses.*—They constitute the most important type of brain abscess and belong to otology. Because of their great therapeutic significance they deserve special mention here. In any case of *ear disease* with symptoms pointing to brain abscess all sources of pus accumulation should be freely exposed and drained. If no improvement is noticed after radical surgical treatment of local conditions, a diagnosis of intracranial disease is justified, when either one or more of the following symptoms are present: (1) headache, often combined with vertigo; (2) vomiting; (3) slow pulse; (4) optic neuritis, from slight engorgement to complete choking; (5) depression of spirits, general apathy, confusion, and somnolence; or symptoms of irritation, such as general or special hyperesthesia, delirium, insomnia, convulsions, or twitchings; (6) paresis of eye or facial muscles.

Occurrence.—Frontal lobe abscess is mostly the result of frontal sinus disease, but may be the consequence of sphenoid trouble; temporal lobe infection is caused by middle ear or antrum disease; cerebellar abscess may be caused by infection from the mastoid cells themselves, either directly or through the intermediary of a sigmoid phlebitis (Macewen).

According to Grunert, 91 per cent follow chronic and only 9 per cent acute otitis media. In 9,000 autopsies at Guy's Hospital, Pitt found 56 brain abscesses, 18 of which were of otitic origin, while only 1 of them was due to nasal suppuration.

In Macewen's opinion two complications of otitis media offer special difficulties in diagnosis; in one of them symptoms closely resembling intracranial extension of disease may be produced by reflex disturbance through the trigeminus nerve. In the last instance patients show no rise of temperature, but display great tenderness, conforming with the trigeminal sensory skin area. Even the hair cannot be touched without discomfort to the patient. Some of these cases complain of a good deal of headache, nausea, and vomiting, so that the resemblance between this condition and cerebral abscess becomes very striking. However, they recover without operation.

The other complication is serous meningitis. In the latter a lumbar puncture, or a decompression craniotomy, with evacuation of the fluid, proves curative.

Prognosis.—This is absolutely bad without operation; it is not brilliant with operation. In spite of the most improved operative technic, the mortality still remains 50 per cent. This is accounted for by the frequent occurrence of a second abscess due to inefficient drainage. Besides, fungus cerebri, purulent meningitis, septic sinus thrombosis, and pyemia are frequent complications (Macewen).

Prophylaxis.—Rhinologists and otologists are alive to the fact that early radical treatment of suppurating processes, while they are extracranial, is still the best treatment of the intracranial complications. According to Macewen, more than one-half of all cases are secondary to suppuration in the otitic and rhinitic cavities. Metastatic abscesses from the lungs may possibly be prevented by attention to suppurating depots in lung and pleura.

Surgical Prophylaxis.—Of the foci near the brain, traumatic injuries occupy an important place. Strict surgical attention must be paid to any trauma applied to the ears, orbit, frontal sinus, pharynx, and antrum of Highmore; these repositories being frequent distributors of the germs causing cerebral abscess.

The possibility for brain abscess to develop, even after a pus depot in the frontal or maxillary sinus has ceased to exist, must be remembered. It is, therefore, advisable to drain freely all suppurating cavities on or about the head, most particularly a diseased ear. Acute suppurating inflammations of the middle ear are rarely the cause of brain abscess. It is mostly the chronic form of middle ear suppuration, with its remissions or intermissions and its tendency to extend to neighboring structures, that has given rise to the worst type of cerebral abscess. No case of chronic suppurating otitis can be considered safe until entirely cured; for, at any moment, and when least expected, a brain inflammation or abscess may flare up so long as there is any pus left in the ear.

When the symptoms indicate that a suppurating process has already extended to the brain cavity, local operative interference is immediately called for. If the signs denote a beginning sinus thrombosis or an extradural abscess with beginning leptomeningitis, radical operation becomes equally urgent. The main object must be, as in skull injuries, to remove instantly infected parts and infectious material, to create free drainage, and to protect the tissues from fresh infection. When minor surgical measures are inefficient to accomplish all this, radical surgery must be employed without delay.

Other prophylactic measures are: timely paracentesis; the removal of polypi and granulation tissue, of carious or suppurating bone, and of necrotic parts. If an extradural abscess has formed between bone and dura, it must be emptied and thoroughly drained. Even the most radical operations may become useless if the process has been allowed to generalize.

Treatment.—There is no more treatment by internal medication for a brain abscess than there is for abscess elsewhere. Treatment is entirely surgical. Only when the abscess cannot be localized may one resort to the use of drugs. However, in no case should we rest content with the administration of internal remedies alone, but should be prepared to do surgery at a moment's notice; at least the patient must be under constant

surgical observation where immediate operation is possible. It is only where radical treatment for one reason or another is impossible that we are limited to the giving of symptomatic relief. Pain, the most annoying symptom, must be relieved by the usual internal and external remedies.

In the beginning local bloodletting is sometimes useful for the pains of otitis, mastoiditis, and cerebral hyperemia. Leeches or wet cups may be applied over the mastoid processes, the neck, and temporal region. Headache may be treated by an ice-cap and cold cloths applied to the shaved head. Vomiting may be relieved by means of chopped ice or small doses of morphin or cocain, hypodermically. The insomnia may be treated by hypnotics, narcotics, or hydrotherapeutic applications.

Operation.—Operation is indicated in all cases of cerebral abscess in which a localizing diagnosis is possible and which can be reached by the surgeon's knife, provided there are no contra-indications.

S. E. Henschen gives the following *contra-indications* for operation:

1. Abscesses of the multiple or metastatic variety without definite localization. When there is doubt regarding multiplicity, but not concerning the localization which is accessible, an operation may still be performed in view of the otherwise fatal prognosis.
2. When the underlying disease is absolutely fatal.
3. When the patient's general condition does not warrant either an operation or an anesthetic.
4. When the brain abscess has broken through the ventricles.
5. When diffuse leptomeningitis has appeared, or when streptococci appear in the lumbar fluid.

On the other hand, according to the same authority, the following complications do not contra-indicate operation: pachymeningitis, extradural abscess, sinus thrombosis, beginning or localized leptomeningitis, and beginning pyemia.

It cannot be reiterated sufficiently often that while operating for cerebral abscess one must not forget to treat surgically the underlying disease, usually an otitis; otherwise there will be new abscess formation.

Up to the present the results of operation on cerebral abscess have not been uniformly good. As each operator has but limited opportunities and statistics are still meager, the time is not ripe to pass definite judgment upon the value of surgery in cerebral abscess. But even now many successful cases of brain abscess of otitic origin are being recorded. Macewen, when he first published his classic on this subject, had the largest number of intracranial abscesses to report. He had in all 30 cases, of which he operated 24. Of these 23 were cured and 7 died. During the past few years reports on brain abscess operations have become more frequent, especially after Macewen's work had appeared. Körner is correct when he maintains that the cases published so far give an in-

correct idea of the value of operation, as only favorable cases seem to find their way into print. In his 1908 statistics, speaking of operative cases in which the abscess was found and evacuated, he mentions 23, of which 11 resulted in cure and 12 died. Of cerebellar abscesses he tabulates 15, of which 4 recovered and 11 died. Of abscesses which were not found he mentions 7 cerebral and 7 cerebellar ones; all of the patients died. After carefully tabulating all the cases in the literature, Körner figures out only 25.66 per cent of cures. This percentage I think too low for the present time; the diagnosis is now made earlier and operations are not undertaken when a patient is already moribund.

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CHAPTER XVII

SINUS THROMBOSIS

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Introduction.—The anatomical peculiarities of the venous sinuses favor clotting within them. Their lumen is irregular and triangular in shape; the walls contain no muscular tissue, and, being imbedded in the substance of the dura mater, their caliber does not vary. When the circulation becomes feeble, as, for instance, in cases of prolonged diarrhea, the blood flow through the sinuses becomes retarded, and thrombosis can readily take place. The superior longitudinal sinus is peculiarly prone to thrombosis, because the veins emptying into it ascend from the surface of the brain, entering in a forward direction, which is directly opposite to the flow of the sinus itself. There are two types of sinus thrombosis. One variety results from conditions of malnutrition and prostration, and is called marantic or primary sinus thrombosis. The other—the more important—is due entirely to extension of infections into the sinuses from other regions; it is, therefore, described as secondary or infective thrombosis.

MARANTIC OR PRIMARY SINUS THROMBOSIS

The superior longitudinal sinus is the seat of predilection for this variety. It is more common in early childhood than in adults, excepting those who are senile and feeble, in whom it not infrequently occurs. In infants prolonged attacks of gastro-enteritis and bronchial disease predispose to this condition. Extreme states of exhaustion following infectious diseases, such as measles, scarlatina, typhoid fever, and diphtheria, can give rise to this variety of sinus thrombosis.

Symptoms.—In a general way the symptoms resemble those of cerebral hemorrhage. There are in both irritation and paralysis phenomena. The disease has similarities with meningitis, fever being present in both; also optic neuritis and contracted pupils, nausea, and vomiting.

In thrombosis of the transverse sinus edema appears in the soft parts of the mastoid region. The external jugular vein is unequally distended on the two sides. When the thrombus is continued into the internal

jugular vein the latter feels as a tight cord, while the soft parts of the neck are swollen. The head is inclined to one side and its movements are accompanied with pain. There are no distinct cerebral symptoms in this type of thrombosis, owing perhaps to the circumstance that blood still flows in the opposite transverse sinus. Thrombosis of the cavernous sinus manifests itself by symptoms of stasis in the orbit, such as swelling of the lids and face, as well as edema of the optic nerve, and sometimes even by paralysis of the ocular muscles.

Prognosis.—The prognosis is quite serious in the majority of cases.

Prophylaxis.—The etiologic factors capable of producing the disease should receive careful attention. First of all, heart weakness—the immediate cause of thrombosis in the sinuses—demands thorough treatment. In the presence of brain symptoms and in hydrocephaloid conditions generally we must beware of the depressing narcotics and the withdrawal of blood from the vicinity of the head. These measures, undertaken, perhaps, for other conditions, prove dangerous by favoring thrombosis. In addition, if it is desired to prevent thrombosis, the heart must be reënforced.

General Treatment.—Stimulants should be administered with a free hand—wine, ether, camphor, spirits of ammonia, and ether injections. Sinapisms over the heart and the peripheral parts are in order. Hot baths are not permitted, because of the cerebral anemia produced by them.

Local Treatment.—One serious danger to be avoided is cerebral hemorrhage, which frequently follows sinus thrombosis. For this, local bleedings are indicated to reduce blood stasis. Nature sometimes shows us the way by causing epistaxis. Leeches may be applied to nose, forehead, temples, and the mastoid region, and wet cups over the neck. Generally speaking, the treatment is that of cerebral hemorrhage. When convulsions and delirium are present narcotics are indicated. After the attack has passed off, and when paralysis, somnolence, and coma appear, stimulating remedies are applied both internally and externally. Paralyses are treated in the same manner as those resulting from hemorrhage, thrombosis, and embolism.

SECONDARY OR INFECTIOUS THROMBOSIS

Etiology.—Frequently the infection is mixed. Several kinds of germs are met with: streptococci, colon bacilli, and pneumococci. The primary cause is usually a chronic purulent otitis media. Rarely is an acute case with pus retention the cause of the infection. Infectious sinus thrombosis may be secondary to thrombosis elsewhere. In the majority of cases thrombosis is an indirect result of mastoid suppuration. The anterior wall of the sinus is first attacked; somewhat later the sinus itself becomes

affected. The right is more often implicated than the left side, for the reason that the sigmoid fossa is larger and extends more anteriorly and outwardly than the left side; the wall of the inner ear being also thinner on the right side. Additional causes are: injury to the cranial bones, osteomyelitis, tuberculous or syphilitic caries, and suppuration of the scalp.

Pathology.—The affected sinus is distended and feels as hard as a cord. A clot adhering to the walls of the sinus usually fills its lumen. In this type of sinus thrombosis the clot may quickly break down into pus, and general pyemia may be a consequence. The ventricular fluid is usually increased, and extensive softening of the brain may occur if this be long continued.

Symptoms.—The symptoms may be divided into three groups: (*a*) cerebral symptoms indicative of some intracranial disturbance; (*b*) local signs revealed by external examination of the head; (*c*) general signs of some bodily condition with which sinus thrombosis is likely to be associated.

Cerebral Signs.—The brain symptoms of infectious sinus thrombosis differ in no way from those of other intracranial lesions. There may suddenly appear attacks of vomiting, convulsions, and coma, which rapidly terminate in death. In other cases the symptoms are not as stormy; there are headache and restlessness, followed by delirium, and sometimes later convulsions and coma. Occasionally there are present the symptoms of meningeal irritation—rigidity of the neck muscles, trismus, unequal pupils, strabismus, nystagmus, irregular pulse, and respiratory disturbances.

Local Signs.—The local signs of sinus thrombosis differ with the situation and the degree of clotting in each case. Their presence only is of value; their absence cannot be considered as negative signs for diagnostic purposes. In disease of the superior longitudinal sinus there may be an edema of the forehead to attract attention to this place. In rare cases the temporal veins may be distended and even thrombosed. Relative emptiness of one side of the superficial veins as compared with those of the other side of the head, which may be distended, favors the diagnosis of lateral sinus thrombosis in the latter. The jugular vein may be felt as a solid cord, very tender on pressure. When the cavernous sinus is affected there is usually slight proptosis of that side, with edema of the conjunctiva and of the upper part of the face. Amblyopia is the rule; the ophthalmoscopic picture shows swelling of the disk, or perhaps thrombosis of the central vein, with multiple retinal hemorrhages. Thrombosis may extend from sinus to sinus; in fact, it is quite the exception to find postmortem that the thrombus has limited itself to one sinus.

Prognosis.—In the majority of cases the disease, if left alone, has a tendency to become rapidly fatal. Cases of infected thrombosis following ear disease have been saved by early surgical interference—tying of

the jugular vein and the affected sinus on either side of the thrombosed area—the sinus being later incised and the clot removed. Where pyemia is present the termination is always fatal.

Prophylaxis.—The prevention of infectious sinus thrombosis is almost identical with the prophylaxis of brain abscess. Every infection near the cranium and elsewhere in the body must be carefully investigated and treated. Even an insignificant trauma to the head is to be considered as fraught with serious possibilities, unless treated according to the most approved rules of asepsis and antisepsis. Likewise, inflammations about the ear, nose, and throat are not to be lightly considered, especially if the inflammation be a purulent one or is likely to become one. While all kinds of inflammations in the nose and its accessory cavities are of great etiological importance as regards the development of infectious sinus thrombosis, nothing surpasses in gravity chronic purulent otitis media. It is necessary, therefore, to pay strict attention to this source, not only after symptoms of brain abscess have appeared, but long before there is any sign of cranial mischief. At no time during the continuance of a purulent chronic otitis media should surgical intervention be declined. All the more is this true when the first signs of extension to the mastoid cells have made their appearance. Then everything possible should be done to rid the patient of the pus depots which threaten his life.

Surgical Treatment.—As nothing can be expected from internal medication, it becomes imperative to resort to radical surgery as soon as possible. The object is to lay open the infectious sinus depot, clear out and drain it thoroughly, and at the same time to evacuate any primary focus which may be found. If the latter has not yet been discovered, every effort should be made to find it. Of the various sinuses we shall speak in particular only of the lateral sinus, because of its great importance.

Thrombosis of the *lateral sinus* is, unless treated, a fatal disease. It is necessary to open the infected sinus in connection with the mastoid and to remove all infectious débris. The diseased tissue between the primary infectious source and the sinus must be removed *in toto*. Especial attention is given to the extradural collections of pus and suppuration in the sinus wall, which are often the mediators or the direct cause of sinus thrombosis; their timely evacuation often prevents the formation of an infected thrombus. Thorough work in this direction is capable of preventing the further growth of an already infected sinus.

As it is usually impossible to prevent the spread of infection through the jugular vein, it will be safe, according to Horsley, to tie the vein before opening the sinus. This is also necessary for the prevention of hemorrhage. According to Jansen, however, tying of the jugular vein is only indicated when the thrombus extends into it. According to the statements of operators, not much is to be feared from pyemia originating in the proximal end of a thrombus.

Contra-indications for Operation.—These are advanced tuberculosis, marasmus, grave sepsis, and especially those diseases which are fatal in themselves.

Results of Operation.—Not a sufficient number of cases have been published to determine definitely what a radical operation will accomplish for infectious sinus thrombosis. Besides, there is a tendency for operators to publish their favorable cases, leaving out those which are apparently of no interest, namely, the fatal ones. From our point of view, this is a mistake.

In comparing the earlier statistics as furnished us by various authors from different clinics, we learn that the majority of surgeons have had on an average 50 to 60 per cent of recoveries, with the exception of Macewen, who can show 72 per cent of cures. Other operators speak of 61 per cent cures. One author, Chapault, cannot boast of more than 50 per cent recoveries. In Körner's last statistics we read of 74 to 77 per cent of cures.

It goes without saying that results depend greatly upon the state in which the patient is found prior to operation, and also upon what complications were present. If an operation can be done before pyemia has occurred, recovery may be expected, unless there are other fatal complications present, such as leptomeningitis, brain abscess, etc. It is always advisable to operate as early as possible before signs of septicemia or pyemia have developed. It would also appear that the tying of the jugular vein seems to exert a favorable effect upon the prognosis, for in the cases in which the vein had not been tied the rate of mortality was higher than in those in which this was done. The cause of death in most cases was either pyemia, brain abscess, or hemorrhage.

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CHAPTER XVIII

TUMORS OF THE BRAIN

JULIUS GRINKER

Introduction.—Ever since surgery has invaded the cranial cavity the subject of brain tumor has assumed immense practical importance. It becomes necessary, therefore, to give adequate space to the diagnostic criteria upon which a rational therapy must be based. For these we are indebted principally to the labors of Bruns, Oppenheim, and Henschen, while in the surgical field most elucidating contributions were made by Horsley, Krause, Cushing, and a host of others. In the preparation of this chapter the writings of all these authorities were freely consulted.

Definition.—A brain tumor may be defined as a growth in the cranial cavity originating from the brain, membranes, cerebral blood-vessels, or cranial bones. Ordinarily by brain tumor is meant a solid growth, though cysts of various kinds are usually included in this definition.

Before entering upon a discussion of treatment, it is necessary to briefly review not only symptoms and diagnosis, but also the pathological anatomy.

Varieties.—The following anatomical kinds of brain tumor will be considered: (1) tuberculoma; (2) syphiloma; (3) endothelioma; (4) glioma; (5) sarcoma; (6) cysts; (7) carcinoma; (8) benign tumors of different kinds.

1. *Tuberculomata* are growths consisting of conglomerations of tubercles of varying size, which usually appear as single or solitary tumors. This type of neoplasm occurs most often in the cerebellum and, according to Allen Starr, is most frequent in childhood. Only those varieties of tuberculoma having a fibrous envelope are capable of radical removal.

2. *Syphilomata* represent the type of infectious granuloma oftenest seen in the adult. Of all syphilitic new formations these are most resistant to antiluetic treatment; they may reach a large size, and are often multiple. In many cases, surrounded by a dense fibrous sheath, and superficially placed in the brain, syphilomata have been successfully

treated by the surgeon after medicines had failed to produce any marked change.

3. *Endotheliomata,* also classified as fibrosarcomata, and formerly considered as true sarcomata, constitute the most frequent form of non-specific benign cerebral neoplasm. These tumors originate in the meninges, are encapsulated, and do not form metastases. As their effects upon the nervous substance are exerted by pressure rather than infiltration, brain functions may be restored to normal after their complete removal. Readily accessible in most cases and easily shelled out of their capsules, these tumors are best treated surgically. Their favorite localization is the cerebellopontine recess on either side.

4. *Gliomata* are tumors originating from the neurogliar tissues appear in two distinct forms—the hard and soft gliomata. The latter, often possessing but little more consistency than brain tissue, have a tendency to infiltrate the brain mass to such an extent that their borders cannot even be microscopically determined. They may reach an enormous size and are often transformed, in whole or in part, into cysts. Further, these tumors are exceedingly vascular and hemorrhages occur in them, which can be mistaken for ordinary apoplectic attacks. The other variety —hard gliomata—are occasionally surrounded by a false capsule, making possible their successful separation from the remaining tissue and their consequent removal.

5. *Sarcomata* are generally of firmer consistency than most gliomata, and can be easily distinguished from the surrounding tissues. When encapsulated they can be shelled out of their covering. The tendency for sarcoma is to spread to adjacent tissues and to multiply by metastasis. Sarcomata are subject to regressive metamorphoses; they either become cystic or undergo mucoid degeneration, forming so-called myxosarcomata. Like sarcoma in other parts of the body, they are not always removable and show a tendency to recurrence. Generally speaking, the symptoms are those of compression, unlike the gliomata, which cause symptoms by infiltration.

6. *Cystic growths* are either the result of parasitic activity, as from cysticercus and echinococcus, or else they follow trauma. They may occur in any part of the brain, and have also been observed in the fourth ventricle. As previously stated, gliomata not uncommonly degenerate into cysts.

7. *Carcinomata* are always of metastatic origin. Usually the metastases lodge first in the cranial bones, and later invade the cranial cavity itself. This is equally true of sarcoma.

8. *Benign tumors* of different kinds occur, but are not common. Examples of each of the following have been reported in the literature: fibroma, myxoma, psammoma, osteoma, cholesteatoma, lipoma, and teratoma.

Etiology.—The true causation of brain tumor is as little known as that of tumor elsewhere. It is certain, however, that, of all predisposing and exciting factors, trauma occupies the first place. Following an injury to the cranium there may be a latent period during which no symptoms are present, and the incident may have been forgotten; after a variable period of time, however, a neoplasm is discovered at the former site of trauma. In this way originate the so-called osteoma and osteophytes. Not only bony tumors, but also those springing from the membranes, have trauma as their exciting cause. The histological make-up of neoplasm following injury often depends upon a patient's constitutional tendencies; in a syphilitic, gummata are likely to appear, while in the tuberculous, the so-called solitary tubercle is more apt to develop.

Situation.—Though a tumor may be situated anywhere in the brain, yet certain types are more constantly found in definite locations. Thus, tuberculoma is common in the cerebellum, syphiloma in the basal meninges, endothelioma in the meninges of the subtentorial region, while cysts are frequent in the cortex, cholesteatoma in the temporal lobes, teratoma in the pituitary body and at the base of the brain. It must be remembered that tumors are not always found in the situation in which they originated, as displacement not rarely occurs.

Brain tumors are divided into *benign* and *malignant* forms. Among the *benign* varieties, also called primary tumors, are named: endothelioma, fibroma, lipoma, osteoma, cholesteatoma, psammoma, myxoma, angioma. As *malignant* tumors are mentioned the metastatic growths, carcinoma and sarcoma. The division is important from the therapeutic point of view, the metastatic growths for obvious reasons being inoperable, while the primary, or benign, tumors, appearing as solitary growths, are proper objects for surgical intervention.

Symptoms.—Not all brain tumors produce symptoms, and it is not rare for a latent tumor to be discovered on the operating or postmortem table. This may be accounted for by the tumor either being too small to produce symptoms, or else, growing very slowly, the surrounding tissue becomes gradually accustomed to the new growth. Another reason might be the situation of the tumor in a "silent" area, such as the frontal, right parietal, or right temporosphenoidal lobe, all of which are still silent in respect to their functions.

The manifestations of brain tumor are divided into (1) general symptoms, due to progressive increase of intracranial tension common to the majority of tumors, and (2) special or focal symptoms, depending upon the portion of brain involved. The last often enable an exact localizing diagnosis to be made.

General Symptoms.—The general symptoms of brain tumor are still the classical three: (1) headache, (2) nausea and vomiting, and (3) choked disk; but several others may now be added to this triad, namely,

(4) vertigo, (5) slow pulse, and (6) convulsions. These are the important ones. They may be present while localizing signs are still absent. This is particularly the case when a tumor, situated in a "silent area" of the brain, affects cerebral functions too obscure for our detection. It is also possible for a small tumor to so obstruct the aqueduct of Sylvius that there ensues internal hydrocephalus, yielding general symptoms, but no localizing ones. Likewise, by reason of the pressure exerted upon the entire brain mass, subtentorial tumors early produce general symptoms, which may be long delayed in frontal lobe tumors.

Headache.—Cephalalgia is an early symptom in most cases and is especially intense in tumors of the cerebellum accompanied by internal hydrocephalus. Severe localized headache is also frequent in superficial cortical tumors. Headache is mild when a neoplasm is small or localized in the white substance. On the other hand, there may be intense neuralgic pains when a growth presses upon such a sensory structure as the gasserian ganglion.

Nausea and Vomiting.—Rarely is there an entire absence of these symptoms. Most frequently seen in tumors of the posterior fossa when the vagus region is directly compressed, they are also observed in neoplasm situated in other parts of the cranial cavity.

Choked Disk.—This is a symptom characteristic for brain tumor, though also seen in abscess, hydrocephalus, etc. According to Oppenheim, optic neuritis is found in 90 out of 100 cases. It is usually bilateral, rarely unilateral; often one side is more affected than the other. Choked disk not being present in all brain tumors, its absence is less valuable than its presence. In the pons it is so frequently absent that this negative finding has almost attained to the dignity of a localizing sign. In the early stages optic neuritis may not be accompanied by visual disturbances. When a neuritis merges into atrophy, vision invariably suffers. Choked disk is an early and rapidly developing sign in cerebellar tumor, which is often followed by sudden blindness. With Sänger and Cushing, I am of the opinion that the process is due to an edema and should be called papillo-edema.

Vertigo.—This is a symptom depending for its production mostly upon disturbance of the vestibular mechanism.

Slow Pulse.—This is usually a late symptom, and may be accounted for by pressure on the vagus nucleus, causing irritation of the cardiac center.

Convulsions.—Convulsions are classed among the general signs of brain tumor, because they occur with cerebral neoplasm regardless of location. The mechanism is explained by pressure upon cortical cells causing constant irritation with subsequent motor explosions.

Special or Focal Symptoms.—Varying with each location, these symptoms enable us to determine the exact seat of a tumor. To explain in

detail all of the focal signs would be equivalent to discussing the entire anatomy and physiology of the brain. Only important points will, therefore, be touched upon.

Focal signs may indicate a tumor in the psychic, sensory, motor, or vasomotor brain territories. We make a distinction between irritative and destructive symptoms. An *irritative* symptom is one which causes hyperfunction; for instance, when present in the sensory sphere, there will be pain; in the motor region, twitchings or convulsive movements. A *destructive* symptom, on the other hand, is one which paralyzes the part; instead of hyperfunction there is absence of function, and the result is motor, sensory, or psychic paralysis. From the point of view of diagnosis, irritative symptoms are of the greatest importance. They enable us to infer that a growth is beginning to impinge upon a certain portion of the brain. Because paralytic symptoms are usually late in appearing and may be caused by neoplasm in distant parts of the brain, they have no localizing value by themselves, but, occurring in conjunction with irritative symptoms, are almost pathognomonic.

Diagnosis.—A correct localizing diagnosis can only be made by careful systematic examination, which includes both negative and positive findings. For a correct pathological interpretation of brain tumor symptoms, one must inquire diligently into the condition of lungs, stomach, kidneys, prostate, and testicles. This conforms to the rule in neurology that, in order to make a pathological diagnosis, organs other than those of the nervous system must be carefully interrogated.

Differential Diagnosis.—A consideration of the etiology, the progressive afebrile course, the presence of choked disk, intense headache, as well as the symptoms of gradually increasing brain pressure, should protect one against mistaking a brain tumor for any other condition.

It must be recalled that not every case of optic neuritis with intense headache means brain tumor, for these symptoms may also occur in chlorosis, polyneuritis, and chronic nephritis.

General paresis under certain aspects resembles brain tumor. The absence of papillo-edema, headache, and vomiting, and the presence of a positive Wassermann reaction, will decide the diagnosis in favor of paresis.

Hydrocephalus is with great difficulty differentiated from certain types of brain tumor. In some cases the diagnosis is impossible. This will be better understood when we recall that the following symptoms are common to both: headache, optic neuritis, nausea, vomiting, vertigo, stupor, and a chronic progressive course. Tumor may be differentiated from hydrocephalus by the possible presence of focal signs and the history of the case. Hydrocephalus is often preceded by an acute infectious disease, as influenza, scarlet fever, etc. In addition, large size of skull, remissions followed by fever, are symptoms indicative of hydrocephalus.

Lumbar puncture will help to determine whether the cerebrospinal fluid is under increased pressure—a symptom of hydrocephalus. A note of warning must here be sounded against the indiscriminate use of lumbar puncture. Several deaths from this procedure have already been recorded in tumors of the posterior fossa, especially of the cerebellum. And it is precisely this variety of tumor which must occasionally be differentiated from hydrocephalus. In such cases it is best to rely upon other differential points.

Pachymeningitis interna hæmorrhagica has many symptoms resembling brain tumor. The etiology of alcoholism or psychosis in the former, as well as focal signs not of the convexity, may also help in differentiation. The fact, however, remains that hematoma is practically a tumor and is treated as such.

Idiopathic *epilepsy* may likewise cause diagnostic difficulties. The absence of optic neuritis and of focal signs favors epilepsy as against tumor. Brain tumor with jacksonian fits may be mistaken for jacksonian epilepsy from other causes. This is particularly the case when the growth is cortical and there is no papillo-edema present. Here the other general symptoms must aid in the differentiation.

Brain abscess has many things in common with cerebral tumor, but it differs in etiology and symptoms develop more rapidly.

Having made a diagnosis of brain tumor, the next step is to *localize* the same.

Regional Diagnosis.—In attempting a localizing diagnosis of the seat of a brain tumor particular attention is paid to the earliest symptoms of irritation and destruction. Careful inquiry should be made relative to the first appearance of localized spasm and paresthesia; for tumors may not cause any other symptoms for a long time. Not only positive symptoms, but also negative findings, are utilized in making the localized diagnosis. Only by excluding every other condition in a given case does the diagnosis become firmly established.

Central Convolutions, Right Hemisphere.—Clinicians are now pretty well agreed that the ascending frontal (precentral) convolution contains the motor area, while the ascending parietal (postcentral) convolution in either hemisphere is the seat of the sensory centers. As a rule, tumors localized in the central convolutions cause both irritative and destructive symptoms.

Motor irritative phenomena appear in the form of localized spasms or tonic muscular contractions, which affect more or less constantly certain muscle groups or movements, such as flexion and extension. The tendency for localized twitchings is to spread successively to the nearest group of muscles. In the beginning there may be twitchings of the fingers only; later the movements extend to the muscles of the forearm, arm, shoulder, neck, and face; still later to the trunk and leg muscles, but al-

ways following the anatomical arrangement in the motor convolutions. The entire half of the body may in this way become violently convulsed. Subsequently the other side may become implicated in the reverse order. The sensorium is usually clear in the lighter grades of jacksonian epilepsy, but in severe attacks there may be partial loss of consciousness. Of great value for diagnosis is an accurate account of how the convulsions begin. Such knowledge practically amounts to the making of an exact localizing diagnosis. According to the late Hughlings Jackson, who first described them and whose name they bear, the localized convulsions occur only in lesions of the central convolutions. Clinical experience and animal experimentation have fully confirmed the truth of his assertion.

Motor paralysis may succeed a jacksonian fit, or it may appear in parts that have never been the seat of spasm. One arm or one leg usually becomes paralyzed first; rarely does the paralysis begin in the face. Frequently the disability in the arm is more pronounced than in the leg.

As previously stated, isolated paralysis may be produced by pressure from a distance, in which event it has no localizing value. On the other hand, muscular twitchings recurring in the same parts and followed by paralysis in these parts, constitute an important focalizing sign.

Sensory irritative phenomena appear in the form of localized paresthesia, such as formication, pain, or disturbances of temperature. They have an importance for local diagnosis similar to that of the corresponding motor phenomena. The more localized the paresthesia the greater is its value as a localizing sign. Sensory disturbances often precede the motor symptoms by a considerable length of time.

Sensory paralysis—anesthesia—is usually not limited or circumscribed, as, for instance, in the corresponding motor disturbance. The more rapidly an entire brain center becomes affected the more pronounced is sensory paralysis. On the other hand, in a slowly growing tumor anesthesia is usually ill defined.

When both motor and sensory irritative phenomena are present, one is justified in localizing a tumor in the central convolutions. On the other hand, the absence of irritative and paralyzing symptoms in either the motor or the sensory sphere almost excludes the existence of tumor in these convolutions and their immediate vicinity. It is to be remembered, however, that a slow-growing tumor in one motor area may not cause any motor symptoms, perhaps because the other hemisphere compensates. The question in any case of motor or sensory hemiplegia often arises: Is there neoplasm growing within the central convolution sphere or elsewhere? The history of the case may offer valuable help. Tumor starting in the precentral convolution or its vicinity may cause monoplegia first, and only later hemiplegia; while, in tumors lower down, as of the internal capsule, hemiplegia is more complete and usually develops more rapidly.

Frontal Lobe.—The localizing symptoms of tumor in this situation are: (1) constant frontal headache which is accurately localized; (2) tenderness upon percussing the frontal bone—valuable only when present. In some cases there are (3) mental signs closely resembling general paresis, such as apathy and complete mental inertia, weak memory, lack of initiative, depressed or exalted mood. In tumors situated on the under surface of the frontal lobe we have: (4) symptoms of anosmia on the same side as the tumor; (5) symptoms of pressure upon the chiasm, optic tract, or optic nerve, causing bitemporal or homonymous hemianopia or unilateral amblyopia. An interesting symptom in connection with frontal lobe tumor is (6) frontal ataxia, a reeling from side to side, which differs in no essential from the well-known cerebellar ataxia.

The Parietal Lobe.—When the superior lobule is implicated, the stereognostic sense may be disturbed, that is, the patient is unable to recognize objects by mere touch. When the tumor encroaches upon neighboring parts, symptoms will appear calling attention to their respective areas: from the postcentral convolution, sensory paralysis; from the first temporal convolution, auditory hallucinations; from the occipital lobe there will be visual disturbances of a kind similar to those from occipital lobe diseases. Other symptoms are localized headache and tenderness on pressure over the parietal lobe. The right parietal lobe, being regarded as a silent area, is recommended by Sänger as the place of choice for decompression operations.

Temporal Lobe.—Though the diagnostic signs of tumor in this lobe are neither marked nor reliable, yet the following points deserve mention:

Contrary to what one may have expected, there is no defect or loss of hearing when the auditory center on one side is destroyed, audition having a bilateral innervation in the brain.

When the lesion is in the hippocampal gyrus and near the tip of the temporal lobe, there are slight olfactory and taste disturbances. However, tumors implicating the cortex of either the uncinate or the hippocampal gyrus are known to produce certain seizures, the so-called uncinate group of fits (Hughlings Jackson). Typical examples of this condition have been studied by Purves Stewart, Mills, Cushing, myself, and others. The uncinate seizures are characterized by peculiar sensations of smell and taste, usually of a disagreeable quality. There may also be an epigastric aura. With the sensory disturbances there may be motor phenomena, such as chewing and swallowing movements, also salivation; consciousness usually being retained. The attacks may be replaced by, or be associated with, so-called "dreamy states," namely, vague feelings of the unreality of surrounding objects.

When a tumor is situated in the posterior portion of the temporal lobe,

near the first temporal fissure, or the second temporal convolution, there may be diminution of vision or homonymous hemianopia without hemianopic pupillary reaction—a neighborhood symptom from the occipital lobe. Similarly, quadrantic hemianopia has been observed in tumors of this region.

Neoplasms of the anterior median division of the temporal lobe near the hippocampus may, by pressure upon the posterior portion of the visual tract, produce homonymous hemianopia with hemianopic pupillary reaction, another neighborhood symptom.

Left Hemisphere.—By reason of the presence of speech centers, localizing diagnosis in the left hemisphere is comparatively easy. Though there are many varieties and a number of types of aphasia, for our purpose it is only necessary to review the three classical speech disturbances. When these are remembered, localizing diagnosis in the majority of cases is not difficult.

Type I.—*Motor aphasia,* the inability to use spoken speech; or the improper use of words, speech-jargon—motor paraphasia.

Type II.—*Word deafness,* total or partial auditory aphasia; sensory paraphasia—the inability to understand spoken speech.

Type III.—*Word blindness* (alexia), the inability to understand printed or written speech.

In *motor aphasia* the lesion is in the third frontal convolution (Broca's center), or subcortical, in the speech tract which runs from this convolution to the inner capsule.

In *word deafness* the lesion is in the middle or posterior division of the first temporal convolution or its vicinity; in paraphasia there is interference with the bundle connecting the first temporal with the third frontal convolution.

In *word blindness* and its concomitant disturbances the lesion is in the angular gyrus, that is, in the posterior lower parietal convolution.

A description of a fourth type of aphasia, the so-called motor *agraphia,* is still being carried from one textbook into another, but it is purely speculative. Though Charcot defended the existence of a writing center at the foot of the second frontal convolution, no convincing anatomical proof for this contention has ever been furnished.

More important than the preceding one is a type of speech disturbance called *optic aphasia.* This is characterized by the fact that a patient so affected recognizes an object and knows its uses, but cannot name the same without resorting to another sense, as, for instance, that of touch. The lesion is found in the bundle leading from the occipital lobe to the first temporal convolution.

Related to the last, but not identical with it, is the condition called *soul or mind blindness.* By this we mean a patient's inability to recall the significance of a familiar object by sight or any other sense; he sees

with his eyes, but not with his brain; and even accustomed locations appear strange to him. The exact localizing importance of soul blindness is not quite certain, but when found in a patient whose intelligence is not impaired it constitutes a pathognomonic sign of bilateral occipital lobe disease.

Occipital Lobe.—Tumors growing here produce mainly disturbances of vision. The symptoms are those of either irritation or of paralysis. The former usually appear first in the form of visual hallucinations of colors or figures (men, animals, objects). The hallucinations are mostly unilateral, and appear upon the side opposite to the lesion; for instance, in a lesion of the right occipital lobe symptoms will be on the left side. Sooner or later homonymous hemianopia without Wernicke's hemianopic pupillary reaction is added to the hallucinations.

To localize accurately a lesion therein one must recall the physiologic data of the occipital lobe.

The visual center, according to modern physiologists—and of clinicians Henschen adopts this view entirely—is limited to the calcarine fissure; the upper portion corresponding to the upper retinal quadrant, while the lower quadrant is represented in the lower portion. The temporal side corresponds to fibers coming from the same side of the retina, the nasal side representing those from the opposite half of each eye. There are, then, crossed as well as uncrossed visual fibers. The occipital cortex elaborates both light and color perception. It is assumed that the macular vision field is bilaterally represented; not so the peripheral field. It is sometimes possible, by carefully measuring the fields of vision during the growth of a tumor, to determine the situation, as well as the extent of an occipital lobe tumor. Blindness in any part of the visual field can only be produced by a lesion of the visual centers, or fibers which lead to them, while irritation of the still functionating occipital lobe, and especially of its lateral cortex, produces only visual hallucinations.

It may be definitely stated that, in the absence of visual disturbances of any kind, no tumor is likely to be found in the occipital lobe.

Basal Tumors.—The principal tumors observed at the base of the brain either spring from the hypophysis or belong to the gummatous variety of syphilis. In either case vision is disturbed because of direct involvement of the visual paths. Here aneurysm, sarcoma, and carcinoma may also be found growing from vessels, periosteum, or bones.

Basal tumors situated anteriorly to the pons may cause pressure upon a cerebral peduncle and a third nerve, producing oculomotor paralysis of the same side and paresis or paralysis of the extremities on the opposite side—the crossed hemiplegia of Weber's syndrome. The tumor may extend transversely and cause a similar paralysis on the opposite side. Extending still more posteriorly, pressure may be exerted upon the tri-

geminus nerve or the gasserian ganglion, producing either neuralgia or anesthesia in the distribution of the fifth nerve.

Tumor in the neighborhood of the *optic chiasm* not only affects the chiasm itself, but may also involve the surrounding structures.

Following are some of the most important symptoms caused by neoplasm in this vicinity:

1. In tumor of one optic tract blindness may appear in a quadrant of the visual field at first, to be followed later by complete homonymous hemianopia with hemianopic pupillary inactivity. When the tumor extends toward the cerebral peduncle, there may be hemiparesis on the same side as the blind visual field and, in addition, paresis of the oculomotor nerve upon that side. In those rare instances of pressure upon the gyrus hippocampus or the olfactory bulb there may develop in addition olfactory disorders—either hallucinations or loss of smell.

2. The tumor, usually a gumma, begins in the optic chiasm; visual disturbances appear with irregular hemianopic defects at first, to be followed by bitemporal hemianopia, eventuating in complete blindness. Instead, there may be optic neuritis or optic atrophy with ocular palsies; when the olfactory structures become implicated in the growth, anosmia may be added.

3. The most characteristic symptom-complex of a tumor in the region of the optic chiasm consists of bitemporal hemianopia with hemianopic pupillary reaction, anosmia, and oculomotor palsies.

4. In *hypophysis tumors* the neighborhood symptoms are identical with those of other tumors about the chiasm. There is at first blindness in the outer fields of vision—bitemporal hemianopia—later complete amaurosis. Optic neuritis and anosmia are rare, but may occur. In some cases visual disturbance is the only symptom present. With tumor in the hypophyseal region is frequently associated the condition of acromegalia. This disease is characterized by enlargement of the bones of the hands, feet, and of the head. A radiogram, which should be made in every case, will almost always demonstrate the presence of enlargement of the sella turcia.

Cushing distinguishes three sets of symptoms in hypophyseal tumor: (1) neighborhood symptoms, (2) general pressure symptoms, (3) symptoms that concern the gland itself.

The *neighborhood symptoms,* visual and ocular disturbances, have already been described.

General pressure symptoms are those of other forms of brain tumor. In their evolution hypophyseal growths break their dural covering, grow upward, and produce directly pressure symptoms, or, indirectly, by obstructing the foramina of Monroe, thereby creating a ventricular hydrocephalus.

As regards the *glandular symptoms,* we have (1) the striking picture of acromegalia, with the enlarged extremities, which is unmistakable; (2) the Frölich syndrome, which is characterized by a peculiar tendency to obesity with sexual underdevelopment or infantilism.

The cause of acromegalia is generally held to be due to a hyperplasia or adenoma of the anterior part of the hypophysis, the glandular portion. Fröhlich's syndrome, on the other hand, is thought to be due to an atrophy of the gland, which may be produced by the pressure of a tumor in its vicinity. If this be the true pathology, it favors the view that the symptoms of Fröhlich's syndrome are caused by a diminution in the glandular secretion—*hypopituitarism;* while acromegalia is assumed to be caused by the very opposite, namely, hypersecretion—*hyperpituitarism.*

Other symptoms caused by neoplasm situated at the base of the brain are polyuria, diabetes, amenorrhea, and impotence, which are attributed by Cushing to metabolic disturbances in the glandular portion of the hypophysis.

The Medulla Oblongata.—Tumors here produce complex pictures, owing to the number of structures crowded together into a small space. The principal symptoms indicate nerve involvement from the eighth to the twelfth inclusive. There may be Ménière's syndrome, or palsies of the palate, vocal cords, and tongue, with or without paralysis of the upper and lower extremities. By pressure upon the vital centers in the medulla cardiac and respiratory disturbances are produced.

Cerebellum.—Cerebellar growths produce both general and local symptoms. The last are caused in small part only by pressure upon, or destruction of, the cerebellum itself; the greater number of symptoms are produced by involvement of neighboring structures, such as pons, crura cerebri, and medulla oblongata.

The principal *general symptoms* are rapidly developing optic neuritis, headache, vomiting, and nystagmus.

The cerebellum, though neither the seat of intelligence nor of the special senses, exercises a regulating control over the neuromuscular sthenic, tonic, and static functions. By its coördinating mechanism it regulates all body movements. The *local symptoms* caused by destruction of the cerebellar substance itself are asthenia, atonia, and ataxia.

In a tumor of the cerebellum there are, consequently: (1) weakness—asthenia—especially of the muscles in the lower extremity on the same side; (2) disorder of equilibration upon standing, which disappears in the recumbent posture; (3) swaying upon standing and walking—cerebellar ataxia; finally, pressure upon the vestibular nerve causes the early and important symptom, (4) vertigo. All of these symptoms belong exclusively to tumor of the vermis, while neoplasm of the hemispheres may give no manifestations until it encroaches upon the former.

Concerning the exact localizing diagnosis, which is of so much impor-

tance to the surgeon, this cannot be made from cerebellar symptoms alone. For this we must also invoke the aid received from pressure symptoms upon neighboring parts, as the acoustic and facial nerves and the pyramidal tracts. After inquiry into the exact order in which individual symptoms have appeared, it may be possible to decide whether the tumor is situated ventrally or dorsally, superiorly or inferiorly.

Cerebellopontile Recess.—The most common variety is an acousticus tumor springing from the sheath of the eighth nerve. These tumors have a unilateral beginning, usually in the cochlear and vestibular nerves; later the fifth, seventh, and ninth nerves are attacked. Added to the symptoms characteristic for cranial nerve involvement, there may be the well-known syndrome of cerebellar ataxia—an uncertainty in standing and walking—and crossed or unilateral paresis in the extremities—pyramidal tract involvement.

Localization of a Tumor.—The needs of surgical treatment require the most exact focal diagnosis to be made. This demands an exhaustive inquiry into the possibility of cranial injury as well as a complete physical examination.

Inspection.—Little can be gained from inspection; only the growths springing from the dura or skull may push their way outward. In children skull deformities may be observed in connection with large tumors and in adults edema of the scalp and engorgement of superficial veins may betray the existence of tumor.

Palpation.—Occasionally the palpating finger may experience a peculiar parchmentlike, crackling sensation, or there may be felt a slight edema and a difference of temperature on the affected side.

Percussion.—Tenderness on percussion is of diagnostic value; a tympanitic percussion sound, or so-called cracked-pot resonance, usually means a tumor underneath in adults, while in children it is suggestive of hydrocephalus.

Auscultation.—A blowing noise is occasionally heard in aneurysm and other vascular tumors, though this phenomenon may still be physiological in children with open fontanels.

Ventriculography.—Of most far-reaching consequence for the purpose of diagnosis—tumor localization—and treatment of cerebral neoplasm, is the new method of localizing brain tumors by means of what Dandy in a number of articles has called "ventriculography." The method consists in the introduction of air into the lateral ventricles after the withdrawal of an amount of cerebral fluid equal to or slightly in excess of the quantity of air to be introduced. By a change of position the air introduced into one lateral ventricle may be made to enter the several other ventricles, of which *radiograms* are then made. A study of the configuration of the several parts of the lateral ventricle on either side, and of the other ventricles, enables one to localize or eliminate cerebral tumor. It has

been found that most tumors during their growth must impinge upon some portion of the ventricular system. This may cause either narrowing or obliteration of the body or of one of the horns, or even a displacement towards the opposite side—changes which are well shown in the radiographic picture.

To introduce air into the ventricles of an adult, it is necessary to make an opening in the skull. This can be done either under local or general anesthesia. The procedure with local anesthesia is but slightly painful and assures good coöperation in the X-ray room.

According to Dandy, a ventriculogram will, in many cases, indicate at once whether the tumor is cerebral or cerebellar. In the latter case an internal hydrocephalus will be evident by the symmetrically enlarged ventricles. The size of the ventricles may be found to be reduced, so that sufficient fluid cannot be obtained to make the injection of air a safe procedure. In such instances—and only then—Dandy advises to make a ventricular puncture on the opposite side and to inject air into the ventricle. Not infrequently a tumor can be localized merely by the difference in size of the two lateral ventricles as determined by the ventricular puncture, or often by the abnormal position at which either ventricle may be reached. Dandy further states, that in a general way a very small ventricle is presumptive though not absolute evidence of a cerebral as against a cerebellar tumor or a tumor of the brain stem; when there is a difference in the size of the two lateral ventricles the tumor is usually on the side of the smallest ventricle. In infants and very young children a puncture can be made through an open fontanel or through sutures which have been separated by the abnormal pressure.

Among some others, the following conclusions from Dandy's article may be cited as indicating the value he places on the new procedure:

1. Ventriculography is valuable in the localization of obscure brain tumors. So-called unlocalizable tumors comprise at present over half of the total number.
2. Practically all brain tumors either directly or indirectly affect some part of the ventricular system.
3. Hydrocephalus is easily demonstrable by ventriculography and when present usually though not always restricts the location of the tumor to the posterior cranial fossa, that is, the brain stem or the cerebellum.
4. Local changes in the size, shape, and position of one or both ventricles as shown by the ventriculogram will accurately localize most obscure tumors of either cerebral hemisphere.
5. Every effort should be made to localize the tumors before resorting to any operative procedure.
6. The usual subtemporal decompression is useless and dangerous

when a hydrocephalus is present, that is, when the tumor is in the brain stem or cerebellum.

7. A suboccipital decompression (cerebellar operation) is extremely dangerous when the lesions are in the cerebral hemispheres.

8. To differentiate between cerebral and cerebellar lesions is frequently one of the most difficult tasks in intracranial localization. Ventriculography at once separates these two groups and indicates the operation of choice.

9. The only cure for brain tumor is extirpation. The results in terms of complete cures of brain tumors will be in proportion to the early localizations which are made. A decompression is a purely palliative procedure and should be adopted only when the tumor cannot be located. Ventriculography permits of an early and accurate localization of the growth when all other methods fail.

10. It is possible to get a separate profile ventriculogram of the whole of each lateral ventricle. Any change in size or contour is easily demonstrated. Anteroposterior views will show the same points in cross section, but they are chiefly useful in showing any lateral dislocation of the ventricles.

11. Many useless and harmful operations will be spared the patient by a judicious use of ventriculography.

Prognosis.—The prognosis of cerebral tumor without operation is unqualifiedly bad, excepting, perhaps, the cases of gummata, which respond to antiluetic treatment.

It has long been known that tumors may undergo regressive changes, becoming converted into fat and calcareous products. Occasionally glioma and sarcoma may liquefy, become transformed into cysts, and thereby lose their tendency to compress healthy brain tissue. To what extent a tumor may become arrested in its development, or so reduced in volume that no more symptoms are produced, we cannot foretell with any degree of certainty. Byrom Bramwell reported a case in which a cerebellar tumor became encapsulated and in course of time ceased to produce symptoms.

Prophylaxis.—Only with reference to syphilis can we speak of tumor prophylaxis. To what degree proper antiluetic treatment can prevent the appearance of gummata is not certain, but we believe that it may do so. Remembering that head trauma often constitutes an exciting cause for the development of gumma, injuries occurring in an individual who has had syphilis demand most energetic antispecific treatment.

In respect to tuberculous neoplasm, trauma must likewise be avoided, as children with tuberculous tendencies are apt to develop tuberculomata after an injury. From the prophylactic viewpoint especial attention must also be paid to existing chronic inflammations of the nasopharyngeal mucous membranes.

Regarding the interval of time between the receipt of an injury and the development of a tumor, various observers make different statements —from "a short time after trauma" to several years. In many of the operated cases the data in respect to a trauma having preceded tumor must be considered uncertain. It is, nevertheless, probable that in some cases there is a clear connection between trauma and tumor, especially when the latter develops under the scar caused by an injury.

General Treatment.—As soon as the diagnosis of brain tumor is made and corroborated by careful neurologic examination, active treatment must begin. The therapy will be: (*a*) hygienic; (*b*) by means of internal medication; (*c*) external remedies; (*d*) by surgery.

Hygienic Treatment.—The general *hygienic* treatment consists in preventing the slightest degree of trauma and congestion to the brain. The patient's life should be so regulated as to avoid all mental friction and shock. If a child, attendance at school should cease as soon as a diagnosis has been made. Adults should likewise abandon serious study, and should endeavor to live free from mental stress.

The diet should be light and may consist principally of milk and soups. Large proteid meals and foods causing cerebral congestion must be avoided. Alcoholic drinks and coffee are to be entirely prohibited. Especial attention must be given to regular daily evacuations of the intestinal contents. Moderate outdoor exercise is permitted, but the patient must never be left alone, for apoplectic attacks and vertigo or epilepsy may occur when least expected.

Symptomatic Treatment.—The most troublesome symptoms are headache and insomnia; both are probably caused by either increased intracranial pressure or by direct irritation or destruction of tissue.

Insomnia not infrequently appears early and reaches a high degree, especially when there is also severe cephalalgia. Treatment aims to reduce the general nervous irritability and to produce sleep directly. The first object is best attained through the administration of sedatives, as sodium bromid in 15 to 30-gr. (1 to 2-gm.) doses three to six times daily, with a double dose at night if necessary. To produce sleep directly 7 to 15 gr. (0.5 to 1 gm.) of veronal or 3 to 6 gr. (0.2 to 0.4 gm.) of luminal may be tried. Of other remedies sulphonal must be mentioned, which can be ordered in doses of 15 to 30 gr. (1 to 2 gm.) at night, but not for long periods. Antipyrin and aspirin have also been used successfully for this purpose. In obstinate cases of insomnia powdered extract of opium in nightly doses of 1 gr. (0.06 gm.) are given. In the most obstinate cases it may be necessary to inject hypodermically $\frac{1}{6}$ to $\frac{1}{3}$ gr. (0.01 to 0.02 gm.) of morphia sulphate in order to produce sleep.

Headache is undoubtedly the most serious symptom from the patient's viewpoint; it may continue for several years and may make his life unbearable. Not rarely with increasing stupor the headache becomes more

intense. For the most part the head pain is constant, although it may appear in paroxysms. To combat it we employ general hygienic remedies, which aim to prevent congestion. Of the nerve sedatives, sodium and potassium bromid occupy the first place; they may be given for a long time in doses ranging from 45 to 90 gr. (3 to 6 gm.) daily. Another useful sedative is sodium luminal in doses of 6 gr. (0.4 gm.) daily.

The remedy enjoying greatest popularity is potassium iodid. According to most authorities, notably Horsley, Wernicke, and others, iodid of potassium affects favorably all forms of brain tumor headache. For this purpose it is best given in moderately large and continuous doses. Of course it is the remedy par excellence for the headaches resulting from syphilitic tumor, for which heroic doses, up to 600 gr. (40 gm.) daily, are administered. Paroxysms of headache require rest and quiet in a dark room. The application of wet cloths wrung out of cold water, or preferably ice placed upon the head, may act efficaciously. Laxatives may occasionally relieve an attack; cooling enemas, as well as cold footbaths and cool general baths, may also be serviceable. Local bloodletting has sometimes done wonders in these cases. Good results have been seen from the application of wet cups and leeches to the neck. Convulsions, stupor, and somnolence have thereby been quickly relieved. In tumors of the frontal lobe, or those localized at the base of the brain, leeches may be applied to the inner canthus of the eye, the temporals, or the mastoid processes. In anemic patients dry cups are given preference to wet cups.

Vertigo is combated in the same way and requires a sedative regimen and rest in bed.

Vomiting, produced by the same causes that bring on attacks of cephalalgia, must be treated in like manner. Chopped ice, dropped into effervescent water and administered in small and repeated doses, has proved grateful. In obstinate cases small doses of morphin, codein, or cocain may be tried. When cerebellar tumors are the underlying cause, ice to the neck and wet cups over the mastoids are indicated.

Spasmodic twitchings in the hand, arm, leg, and general epileptiform convulsions may become very troublesome. These are treated symptomatically, the same as though they were produced by causes other than neoplasm. When the convulsive attacks become more or less chronic, sodium luminal in combination with potassium iodid, in average doses (1½ gr.), should be administered. For serial convulsions, which may become life-threatening, nothing is better than morphin injections repeated until relief is obtained, for bromids will accomplish but little in these cases. At the same time it is well to apply ice to the head and to administer chloral enemas. Inhalations of chloroform, frequently repeated, have sometimes succeeded in checking convulsions. More powerful in their effects upon epileptiform attacks are bloodletting and venesection. These measures

have not only checked convulsions, but have relieved other annoying tumor symptoms. We must never forget, however, that in advanced cases of tumor the brain is often bloodless from pressure, and that an additional sanguineous loss may produce sudden death by anemia of the medullary centers. Blanched face and general debility, cardiac irregularity and weakness, and particularly advanced age, are all contra-indications to venesection and wet cupping. It is remarkable that, after bloodletting, paralysis and optic neuritis may temporarily subside. However, when vision is threatened it is not safe to wait. Operation is then to be resorted to without delay, either for decompression or for radical removal, as vision once lost cannot be restored. This advice is concurred in by leading surgeons and neurologists.

OPERATION

The only rational method of treating brain tumor is by surgical operation. As the trephine is a two-edged weapon, it should be employed only after carefully considering the following points:

1. Some tumors spontaneously undergo regressive changes, or become quiescent.
2. Slow-growing tumors may produce very insignificant symptoms, or patients may remain free from symptoms for many years.
3. Syphilitic tumors may disappear entirely after continuous or interrupted courses of specific treatment.

An operation should be performed when there is the prospect of either prolonging the patient's life or of making it more comfortable. When neither can be hoped for, operation should be desisted from.

I cannot agree with those who claim that the prognosis as to life is better in patients who have not been operated upon and that brain operations should be abandoned. Regardless of the case citations, according to which patients have lived up to forty-five years after the beginning of tumor symptoms, the fact stands out prominently that the great majority of cases die when left alone. It is true that in many instances life has been shortened by the risks incident to operation, but it is equally true that many other lives have been prolonged.

The causes for failure of operation are many. Of prime significance is the fact that it is not always possible to make a correct focal diagnosis. In numerous cases the literature makes record of the fact that the surgeon opened the skull and, not seeing any evidences of tumor, closed up the wound without having opened the dura. A postmortem subsequently revealed a tumor under the operation wound. In other cases a tumor was not discovered at operation, because the surgeon failed to explore the

immediate vicinity, but the tumor was subsequently found. Even when symptoms have pointed definitely to the existence of a tumor in a certain location, good observers have found themselves facing a so-called pseudo-tumor (Nonne and others).

Operability of Tumors.—Which tumors are considered operable? Statistics show that, contrary to expectations, gummata, echinococcus, meningeal tumors, and tuberculomata, when found during operation, were removable, while numerous gliomata and sarcomata were inoperable, either on account of their large size, or because they had infiltrated the neighboring brain substance. The operability of a tumor will also depend on whether it is encapsulated, circumscribed, or diffuse. A circumscribed or encapsulated tumor is usually operable, while one belonging to the diffuse variety is mostly always inoperable. The location of a tumor will also determine whether the same is to be treated surgically or otherwise. While tumors of the convexity are readily accessible, those situated at the base or in the ventricles cannot easily be reached. It must be noted, however, that since 1898 basal tumors have gradually gained favor as objects of surgical attack. Among the basal growths those situated in the cerebellopontile angle and tumors of the hypophysis have been drawn into the domain of surgical therapeutics.

The surgery of the hypophysis has been furthered by a better knowledge of its physiology and of its clinical symptomatology. It is chiefly due to the daring of men like Horsley, von Eiselsberg, Cushing, Kanavel, Halstead, and a number of others that the hypophysis has become accessible to the surgeon's reach. The operative technic has received such wonderful improvement that hypophyseal tumors can now be reached through extracranial routes, and the customary dangers of cranial operations can thereby be entirely avoided.

Operations upon the occipital, parietal, temporal, and frontal lobes have not been uniformly successful.

The various kinds of operation are: (*a*) exploratory; (*b*) palliative; and (*c*) radical.

Exploratory Operation.—Many authorities consider exploration, in the case of a doubtful focal diagnosis, justifiable in the hands of careful operators. Deaths have occurred within a few hours to a few days following operation. In these cases either no tumor was found or only partial extirpation has been done. Henschen is of the opinion that exploratory operations are not to be undertaken except in the presence of the most serious symptoms, while Dandy, on the other hand, advocates radical operation even when tumors are situated in almost inaccessible parts of the brain.

Palliative Operations.—The following are the most useful palliative surgical measures: (1) lumbar puncture; (2) ventricular puncture; (3) decompressive operation.

1. *Lumbar puncture* is the easiest and least harmful of any of the palliative operations proposed. It can be done repeatedly and without an anesthetic, but must be executed slowly and with care, as the sudden withdrawal of spinal fluid causes harmful reactions. One great danger is the crowding down of the pons medulla into the foramen magnum, with the production of almost instantaneous death, especially in tumors of the posterior fossa. A good plan is to withdraw a small quantity of fluid with the patient in the Trendelenburg position. As the withdrawal of fluid through spinal puncture can produce a decided temporary reduction of intracranial pressure, this procedure is recommended in all those cases in which more serious operations are contra-indicated. It has been found useful for the relief of severe and constant headache, vomiting, etc., provided these symptoms are the result of internal hydrocephalus. The puncture may have to be repeated several times, as permanent drainage cannot be introduced in the spine. The amount of fluid to be removed at each sitting varies from 50 to 60 c.c. In one of my cases of inoperable cerebellar tumor a cautiously performed lumbar puncture relieved a persistent headache almost instantaneously.

2. *Ventricular puncture* after trephining has been undertaken in a limited number of cases. Reports indicate that there has been relief from pressure symptoms, such as headache and vomiting.

3. Of greater practical importance is the so-called *palliative operation.* Numerous observations have demonstrated that the mere removal of a portion of the cranial vault in cases in which a tumor was either not found or could not be extirpated has given great relief. Violent headaches, which previously had embittered the patient's existence, had disappeared after the operation. Perhaps the weightiest reason for its performance is to save the patient's vision after choked disk has developed, for, when secondary atrophy supervenes, permanent blindness is inevitable, and the time has passed for any kind of surgery. Decompressive operation is advocated by many competent observers, of which number might be mentioned Oppenheim, Sahli, Bruns, Bramwell, Horsley, Sänger, Cushing, and others. In fact, Cushing has perfected a method of his own, which aims to utilize the strong temporal muscles as a covering for the brain defect made by the removal of bone. He maintains that his operation prevents or at least minimizes the amount of cerebral hernia which follows other forms of decompression. The Cushing decompressive operation, performed over the right temporal area—a silent portion of the brain—has been generally adopted by surgeons in this country. Sänger, of Hamburg, long ago suggested that the right parietal lobe, another silent area, be utilized for decompression. This has become the popular decompressive operation in Europe. Either of these palliative operations may be resorted to when the patient's life is in danger, or when symptoms become unbearable. It must never be lost sight of that such operations

are not devoid of danger, and that a number of deaths have followed. Here, as elsewhere, the danger of the operation lies more in the operator than in the operation. For the careful operator the decompressive operation should have no terrors.

Trephining Operation with Extirpation.—The object of this operation is to remove a tumor in whole or in part, with a view of prolonging life or relieving symptoms. As to what degree extirpation has been successful in either respect we still lack exact information, as surgeons are loath to report their failures, and preferably select for publication their favorable cases.

The mortality after partial or total tumor extirpation is still great. The fatal cases mostly belong to the category in which a tumor was not totally removed on account of its large size or because of its being too diffuse. Patients who survived the radical operation were benefited in the larger number of instances, though permanent results were obtained in only about 3 to 4 per cent of cases. Some patients were so far restored to health that they were able to resume their ordinary activities. In searching through the literature one encounters numerous records of cases in which after extirpation of a tumor life had been prolonged for many years.

Of the various kinds of tumor, operative cures have been frequently observed in gummata. In gliomata and sarcomata recovery after operation was not as frequent; but in a number of instances patients have lived up to two years. The operative prognosis is relatively good in echinococcus disease, and recoveries have been reported after operations for the removal of tuberculomata.

Dagers of Operation.—The most common dangers of operation are shock, hemorrhage, debility, sepsis, and meningitis.

Among the causes producing death after operation shock occupies the first place; patients have died suddenly with symptoms of cardiac or respiratory paralysis. In cerebellar tumors this is probably due to direct implication by pressure of the vital centers in the medulla; in others pressure may have been from a distance.

Hemorrhage has produced fatalities more often in extirpated than in non-extirpated tumor cases. Death has also been caused by extensive sinus hemorrhage, owing to anomalies of the torcular herophili; or when a tumor originated from the sinus itself. Fatalities from hemorrhage usually occurred before the expiration of two days following operation.

Sepsis and meningitis developing after operation have caused a fatal issue within a few days. When death has followed careless asepsis it took place not later than a month after operation.

I agree with Henschen that a study of the exact causes of death following operation should impress us with the following rules:

1. Carefully observe strict asepsis and antisepsis, so as to prevent septicemia and meningitis.

2. Avoid the deleterious effects of hemorrhage by carefully treating the patient before and after operation, so as to increase his powers of resistance.

3. Minimize the effects of shock by operating in two stages (Macewen and Horsley).

4. Debilitated individuals and weak children should receive a course of tonic treatment before operation, in order to fortify them for the operative ordeal.

5. Operate when the tumor is still small and removable; after it has grown to considerable size it belongs to the irremovable kind.

6. In suspected or frankly syphilitic tumors do not spend more than six weeks' time with antispecific medication. If after the expiration of this period no benefits accrue from large doses of mercury and iodids, and no contra-indications are present, the case should be operated at once (Horsley).

7. In tumors considered inoperable, because of large size, inaccessible position, or because localization is impossible, a decompressive operation may be resorted to with a view of prolonging life.

8. Cerebellar tumors should be operated in two stages, because of their special tendency to cause respiratory paralysis when the medulla is not given an opportunity to accommodate itself gradually to new conditions of pressure.

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CHAPTER XIX

ANEURYSM OF THE CEREBRAL ARTERIES

JULIUS GRINKER

Introduction.—Excepting the small miliary aneurysms giving rise to cerebral apoplexy, aneurysms of the cerebral arteries are more frequent than any other variety.

Etiology.—Most often occurring in connection with the arteries at the base of the brain, the middle cerebral comes first in frequency, then the basilar, vertebral, and, last, the anterior cerebrals. The favorite location for an aneurysm is at arterial bifurcations. We distinguish two varieties: (1) the saccular, or so-called true aneurysm, and (2) aneurysmal dilatation of cerebral vessels. The last variety is found especially in connection with the vertebrals and the basilar artery. Aneurysms vary in size from a bean to a hen's egg. Of the two hemispheres the left is more frequently affected.

Pathology.—Aneurysm of the cerebral vessels has a pathology similar to that of aneurysm elsewhere. Its principal cause is a diseased blood-vessel. As the majority of patients are recruited from the young and middle-aged, we assume that the common etiology is cardiac and luetic disorder; only a small proportion of cases occurring in those with senile arterial degeneration. Embolism is also responsible for this condition by producing partial occlusion and subsequent dilatation of the artery caudal to the embolus. Trauma is considered another exciting cause in those who are the subjects of degenerated arteries.

Symptoms.—There may be no symptoms when a slight aneurysm exerts no pressure upon the surrounding brain substance. Besides, an aneurysm may permit a blood current to pass through an affected vessel still adequate to nourish the brain, and will consequently not cause symptoms. When symptoms are present they usually have a gradual beginning and are divided into general and local ones.

Among the *general symptoms* are to be mentioned mental disturbances, such as irritability, forgetfulness, and apathy. Further, optic neuritis and pulsating sensations in the head, occasionally accompanied by a murmur, audible even to the examining physician, are additional

symptoms. Pressure upon either the carotid or the vertebrals may cause a cessation of the pulsating murmur, in which event this general symptom may be converted into a local sign of value.

The local symptoms are similar to those caused by pressure of tumors upon certain portions of the brain and cranial nerves. In aneurysm of the internal carotid artery loss of vision in one eye and paralysis of eye muscles may be produced. When the left middle cerebral artery is involved, symptoms of compression of the under surface of the frontal lobe and the internal capsule may appear. The patient then suffers from a gradually increasing hemiplegia with or without aphasia. In connection with the basilar artery, an aneurysm may cause the usual symptoms of pressure on pons, medulla, and of the cranial nerves springing therefrom—the fifth, seventh, eighth, and vagus group. In short, we may have cerebral paralysis on one or both sides and of the involved cranial nerves, namely, severe headache, facial palsy, tinnitus aurium, vertigo, aphonia, dysarthria, dysphagia, and respiratory disturbances.

Differential Diagnosis.—Cerebral aneurysm must be differentiated principally from brain tumor. This may be impossible unless a murmur is heard over the seat of aneurysm. It must be remembered, however, that a superficially placed vascular neoplasm may give the identical symptom. When tumor symptoms point unmistakably to the cavernous sinus, an aneurysm is the probable lesion.

Prognosis.—This is exceedingly grave. It is possible, however, for a cerebral aneurysm to become obliterated the same as other aneurysms—a very rare occurrence. The majority of patients die from hemorrhage by rupture of the aneurysmal sac, or else they succumb to paralysis induced by pressure upon vital centers. When the aneurysm bursts, the patient lapses rapidly into coma, and death supervenes. When a hemorrhage floods the motor centers, convulsions may precede the fatal outcome. Cases do not all terminate rapidly; in some the end is delayed for from two to three years from the beginning of a fully developed aneurysm.

Treatment.—From the viewpoint of prophylaxis everything must be done to prevent a rise of pressure in the brain. The diet should be nonirritating and consist of bland, nourishing food. Alcohol, tea, and coffee are to be absolutely excluded. Mild laxatives are to be administered daily.

In the majority of cases nothing more can be done for cerebral aneurysm than to attempt to alleviate symptoms. Some maintain that the continuous use of sodium iodid has produced cures. In my own experience this remedy has failed. With a specific etiology, both mercury and 606 are to be pushed to the limit, exactly as though we were dealing with a case of brain syphilis. In some cases of aneurysm of the internal carotid artery the common carotid has been tied with success; in others death was the outcome. Cazin reports a complete cure from digital com-

pression of the common carotid. According to Oppenheim, lumbar puncture is contra-indicated, for it has caused instant death by rupturing the aneurysm. A practical point in connection with the surgery of brain tumor is that an operation on a mistaken aneurysmal tumor may cause either rupture and death, or an undue expansion of the sac by the release of pressure, thereby aggravating conditions.

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CHAPTER XX

THE PARASITES OF THE BRAIN

JULIUS GRINKER

Introduction.—The most important parasites infecting the brain are the echinococcus and the cysticercus cellulosæ. Of these the latter is the more frequent. Either of them may be found singly, but in the majority of cases they appear in large numbers diffusely scattered over the brain. Cysticerci follow the soft membranes into the fissures and also invade the ventricles, in which they may float or become attached to the ependymal lining. Echinococci have a similar distribution, but are also found in the medullary substance of the brain.

Symptoms.—The brain has been observed to be literally studded with cysticerci or echinococci, and yet no symptoms were present during the life of the individual to indicate their existence. On the other hand, sudden death has resulted from this disease as the first and only symptom.

The symptoms are vague and variable and are not pathognomonic. Of greatest frequency are convulsive attacks. Most often these have the typical characteristics of hysterical spasms, in that they are of long duration, consist of large movements, and are not accompanied with loss of consciousness, or there may be only clouding of the sensorium. During these attacks the patient may pass through the most grotesque contortions; opisthotonos has frequently been observed. There may be but slight twitchings in certain muscles, as of the face and the anterior portion of the neck. Mere tonic contractions without clonic movements are not rare. In addition there may be the symptom commonly described as globus and also the peculiar sensation of a nail being driven into the head, so-called clavus. In fact, the entire array of symptoms belonging to true hysteria may be found in cases suffering from cysticercus of the brain. On the other hand, the convulsions may appear at irregular intervals and be accompanied by complete loss of consciousness, biting of tongue, frothing of mouth, followed by a dazed condition and somnolence; in other words, the patient may present the picture of true epilepsy, for which the condition has often been mistaken.

Mental disturbances of every grade have been noted in connection

with the development of these parasites in the brain. Not rarely imbecility and a state of dementia resembling true general paresis have been seen. Irritability, excitement, delirium, and confusion are the most common psychic manifestations occurring either temporarily or remaining as a more or less permanent condition. Depending upon the location, there may be the focal symptoms of monoplegia, hemiplegia, hemianesthesia, aphasia, etc., which may be of short or long duration. Cysticerci or echinococci situated in the fourth ventricle produce glycosuria, cerebellar ataxia, vomiting, and respiratory and cardiac disturbances. Cerebellar involvement announces itself by occipital headache, vertigo, and a reeling from side to side. Irrespective of the location of the parasite, headache and vertigo are common symptoms. Cranial nerve involvement has its own symptomatology and differs in no particular from that of pressure by a tumor. An important feature of cysticercus disease is the predominance of the irritative symptoms over the paralytic phenomena and the occurrence of intermissions, during which the patient may enjoy perfect health. Perhaps the irregularity and variability of symptoms may be explained by the power of locomotion possessed by the cysticercus.

Diagnosis.—This is very seldom made. One may suspect the disease when there are present cysticerci in the skin or muscles, which can be felt as movable bodies. Excision and microscopic examination of a piece of muscle will make the diagnosis certain. Intermittency of the symptoms may direct attention to the possible existence of this disease. Bruns has described in one of his cases the periodic appearance of headache, vomiting, and vertigo, followed by a relative feeling of well-being. After the attack had passed off, the patient was obliged to avoid rapid turning of the head and sudden changes of position, as these regularly brought on paroxysms of vertigo and nausea sufficiently intense to throw him to the floor. He considered these symptoms characteristic for the existence of floating unattached cysticerci in the fourth ventricle. Oppenheim calls this syndrome Bruns' symptom, but maintains that it also occurs in attached cysticercus as well as in other conditions.

Prognosis.—This is exceedingly grave. However, an arrest of symptoms and even a cure are possible, as was proved by the postmortem finding of calcified cysticerci, which had ceased to produce symptoms during the latter part of a patient's life.

Prophylaxis.—Prophylaxis is of the greatest importance. Patients should be warned against the consumption of raw or underdone pork. Those affected with tæniæ should not delay taking the usual tapeworm remedies.

Treatment.—The treatment of brain cysticercus is mostly symptomatic. In several cases the motor area was operated on with successful removal of the parasite; but the condition being usually multiple, the futility of such an operation is apparent in the majority of cases. Lumbar

puncture here is dangerous, especially when the cysticerci are situated in the posterior fossa. Bruns proposed ventricular puncture in cases of cysticercus of the fourth ventricle, provided the symptoms indicate that the cysticercus is attached. Oppenheim, who first opposed this procedure, became convinced of its efficacy after having witnessed Krause perform the operation successfully on one of his patients. He recommends that patients be prepared for this operation by remaining quietly in bed, with the head fixed in one position, so as to insure permanent fixation of a freely movable cysticercus, if such should be present.

Echinococcus cerebri may run its course without any manifestations. As a rule, the symptoms are those of ordinary brain tumor. Headaches are aggravated by movement, and the patient often has a feeling as though something was moving in his head. It must be noted that, according to Westphal, the swelling has a tendency to extend outwardly, eroding the bones of the skull and even penetrating into the nasal cavity. The bones may become thinned out sufficiently for a fluctuating mass to appear, which can be punctured for diagnostic purposes.

The symptoms usual for tumor in the motor area have given rise to operations which unexpectedly disclosed the existence of echinococcus. As there is no treatment of this disease other than that for brain tumor, the mistake is of no consequence.

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CHAPTER XXI

HYDROCEPHALUS

JULIUS GRINKER

Introduction.—An accumulation of serous fluid may occur in the ventricles or in the subdural space. It may be an acute or a chronic process, congenital or acquired. The accumulation in the ventricles, whether of inflammatory or purely mechanical origin, is called internal hydrocephalus, while a similar collection of fluid in the subdural space is called external hydrocephalus. Acute hydrocephalus is the result of tuberculosis and other varieties of meningitis. In this chapter the chronic forms only will be discussed under two subheadings, (1) congenital and (2) acquired hydrocephalus.

CONGENITAL HYDROCEPHALUS

Etiology.—The causes of this form are either prenatal disturbances of nutrition or irritation of the meninges, producing an increased secretion of cerebrospinal fluid. Physical and psychic traumata to the mother during pregnancy have also been made responsible for this condition. It is more probable that ill health, drunkenness, and syphilis in the parents are the real causes. There undoubtedly exists a family tendency to this disease, as several hydrocephalic children have been observed in the same families.

Diagnosis.—This is made principally by the changed contour of the skull and the wide separation of the cranial bones; also by Dandy's ventriculography. With an increase of fluid pressure symptoms increase, either gradually or suddenly. During a sudden accession of symptoms we often have the irritative phenomena of delirium, convulsions, or tremors in arms and legs, nystagmus, and fibrillary twitchings in the face. The patient usually succumbs to an acute exacerbation of the disease. When recovery does occur, the child almost invariably shows retarded development in body and mind, is apathetic, does not walk and talk until an

advanced age, and seems to lack the capacity for intellectual growth. Often there is added to this picture optic atrophy with complete blindness.

Prognosis.—Fortunately in many instances the hydrocephalic child does not survive its birth, as brain puncture often becomes necessary to make delivery possible and to save the mother's life. Should a child escape destruction by this means, the prognosis nevertheless remains unfavorable, for hydrocephalus is usually progressive and the patient dies after months or years. In the lighter grades of hydrocephalus a child may live a long time. In the majority of cases, however, death is caused by intercurrent complications or by successive increases of hydrocephalic fluid bringing on a fatal termination. Rarely have patients, usually idiotic, reached the age of forty or fifty years.

ACQUIRED HYDROCEPHALUS

The exact cause of this condition is still unknown. It is possible that a slight congenital hydrocephalus had existed unnoticed for months or years, and, owing to some trauma or other cause, the condition had become aggravated. Henceforth a serious array of symptoms became manifest for the first time—and this may have been considered as the beginning of the disease. It is certain, however, that in numerous cases no such congenital origin need be assumed. There are types which are purely secondary to other diseases, and consequently do not demand special consideration, as they fall under the treatment of the primary conditions causing them. Of this character is the hydrocephalus caused by pressure of a tumor mass upon the venæ magnæ Galeni, when the tumor is situated in the posterior fossa. From like causes the foramina of communication between the aqueduct of Sylvius and the ventricles may become occluded; also those between the latter and the subarachnoid space. It will be seen that a diversity of conditions may give rise to hydrocephalus in one or more ventricles. Possibly many of the convulsive and other attacks occurring in cysticercus disease of the brain are due to the parasites causing similar blockings with ensuing hydrocephalus. In widespread meningeal inflammations of tuberculous or purulent origin the openings of communication between the ventricles themselves, or between these and the subarachnoid space, may be occluded by exudates with resulting hydrocephalus. In addition a number of marantic conditions, as chronic pulmonary tuberculosis, nephritis, diabetes, and cachexias in general, are accompanied or complicated by hydrocephaloid states of the brain.

Diagnosis.—The same diagnostic criteria apply here as in the congenital variety of the disease. In children there will be added to the various symptoms of brain pressure the objective evidences of enlarge-

ment of the skull and separation of sutures. In adults objective head signs are usually wanting, but there are symptoms of increased intracranial pressure without focal evidence of other organic disease of the brain, notably tumor, which enable a diagnosis to be made in most cases.

Prognosis.—This does not differ materially from that of the congenital variety.[1] There are records of recovery, improvement, and arrest of the disease. Acute exacerbations and a sudden increase of fluid raising the intracranial pressure endanger the patient's life.

TREATMENT OF CONGENITAL AND ACQUIRED HYDROCEPHALUS

As both the congenital and acquired forms of hydrocephalus require similar treatment, what follows will apply to both varieties.

It must be noted that no remarkable innovations have been made in the treatment of hydrocephalus during the past fifty years. The surgical treatment, being now done under better aseptic precautions, has perhaps become somewhat more aggressive, but it is doubtful if it is accompanied by better results. According to Henschen, it would sometimes appear as though the more conservative treatment of the past has been more efficacious.

In every case great insistence must be placed upon the proper hygiene for the hydrocephalic child. A general invigorating treatment according to the best rules of our art should be followed in every instance. These children require plenty of fresh air, sunlight, good food, baths, the care of the skin, and attention to the bowels. It is also essential to prevent as far as possible the occurrence of traumata, such as falls and bruises, which usually come to all children, but particularly to the clumsy hydrocephalic, because of his abnormal brain development.

As regards the causative treatment of the disease, this can seldom be applied, for the reason that in most cases we are ignorant of the underlying etiology. Of course, in hydrocephalus with syphilitic antecedents specific treatment is indicated. It would appear as though the results achieved in the past with the iodids and mercury were largely because of a syphilitic etiology. Cures have actually been reported from this treatment, both in the early as well as in the late forms of this disease.

Rachitis has also been thought to play an important rôle in the production of hydrocephalus. In such instances the treatment should be with cod-liver oil,[2] iron, malt extract, fresh air, good food, and hydrotherapy; attention should also be given the digestive and intestinal tracts.

The acute *attacks* frequently occurring in this disease, such as con-

[1] This statement is not accepted by many authors.—Editor.

[2] Phosphorus.—Editor.

vulsions, stupor, etc., which are mostly due to fresh accumulations of cerebrospinal fluid, require especial consideration. The treatment is very much like that of meningitis. Local bloodletting, antipyretics, salicylates, and cold applications are ordered. When the attack threatens life, either spinal or brain puncture should be performed.

The *symptomatic treatment* corresponds very nearly with that of the acute form. The main object is to reduce the amount of cerebrospinal fluid and to prevent its reaccumulation. To accomplish this, internal and external remedies are applied.

Internally we give first of all the iodids, reputed to be the best absorbent remedy, in the form of the potassium or sodium salts; also iodid of iron. The giving of iodin in one form or another is by no means new, but, as no real progress has been made, we are forced to use the old treatment. In addition mercurials may be tried, a drug formerly much used in hydrocephalus. The most definite indication for its use is furnished by a history of hereditary or acquired syphilis. Calomel in small doses and other laxatives given over long periods of time have also been endorsed in the treatment of this disease. The diuretics digitalis and squills in combination have frequently been tried with apparent benefit. Tonics are always indicated.

External Remedies.—These principally belong to the class of counter-irritants, such as the blistering agents, unguentum tartrate of antimony and croton oil, sinapisms, etc. The effects of all these remedies are uncertain, but during the last few years Quincke has again insisted upon their use. Compression of the head has been recommended by many good authorities with the intention of reducing its size and to prevent further enlargement. In some cases the patient is unable to tolerate even slight pressure; in others decided improvement was noted, and even cures have been recorded.

Brain Puncture.—Brain puncture, an ancient procedure, has recently been revived and fervently advocated. While this is really only a palliative remedy, it occasionally relieves the pathological condition present. In this respect its effects are similar to those of tapping for a pleuritic exudate—slight release of pressure seems to start the work of the absorbents. Some patients have recovered by a spontaneous bursting of the hydrocephalus and by an escape of fluid through nose, orbit, mouth, or through a fractured frontal bone.

Mode of Procedure.—In puncturing the brain some advise to allow only a small amount of fluid to escape. Still others desire to limit the flow to the constant dribbling obtained through a capillary trocar or a horsehair drain. Another suggestion is to make several small trephine openings, so as to prevent possible septic infection. When large quantities of fluid are suddenly removed, convulsions, stupor, and death may occur—symptoms which are produced either by cerebral circulatory dis-

turbances or by the dislocation of vital parts of the brain. Huguenin recommends the withdrawal of from 60 to 100 c.c. at each tapping and advocates a repetition, if necessary, but warns against aspiration. Immediately after puncture or drainage appropriate compression of the skull should be made. For this purpose antiseptic bandages are now being used.

Results of Puncture.—In the pre-antiseptic era fatal results were frequent. Since we have learned to withdraw smaller quantities of fluid under aseptic precautions, septic infection is not common. During the last few years the tendency has been to do simple brain puncture or to combine with it drainage of the ventricles. In addition there was inaugurated the treatment by means of so-called lumbar puncture, with which Quincke's name has become inseparably linked. Single puncture is now the prevailing practice—formerly multiple punctures were made.

With the exception of a solitary case here and there, the entire practice of brain and lumbar puncture has yielded meager results. It is, therefore, opportune to give W. Kausch's sanguine views on the treatment of hydrocephalus by ventricular puncture, with an abstract of what is considered his own technic:

He insists first of all upon strict asepsis in ventricular puncture and advises that this little operation be performed by a surgeon. Under all circumstances does he discourage ambulatory treatment. For this operation he selects an open area which leads in the direction of the ventricles, avoiding the motor and speech centers—this in the open skull. For the closed skull he recommends that the frontal region be utilized, carefully avoiding the important brain centers and the larger vessels. He prefers this location to the usual area above the auditory meatus recommended by the majority of writers, and he drains the ventricles by alternately selecting different spots over perfect skin areas. In addition he draws the skin tight, in order to bury the puncture spot and thus prevent infection. In explanation of the effects of ventricular puncture he gives the following lucid statement:

"The communications between the ventricles and the subdural and subarachnoid spaces are numerous; likewise between the latter and the venous and lymph channels. The avenues of escape toward the cranial periphery are limited. During the development of hydrocephalus the production of liquor has been so rapid that the outgoing paths could not carry it off; the latter soon became compressed and a vicious circle was established. After the paths had again been made patent and kept so, the hydrocephalus gradually disappeared."

After each tapping he measures the pressure, aiming to eventually bring it to below the normal. He does not hesitate to reduce the circumference of the fontanel 20 cm. after each tapping. Further, he places

no limit upon the amount or fluid to be withdrawn; his rule is, the larger the head the more fluid should be removed—from 100 to 300 c.c. have been taken out at one sitting. The procedure he repeats whenever necessary. His only criterion for repetition is the rapidity with which fluid reaccumulates and the fontanels appear to bulge out. In the beginning of treatment he punctures daily, later once every few days. He believes himself to be the first to have recommended such energetic and persistent puncturing for hydrocephalus. Briefly he attempts to answer a number of objections usually made against his procedure. One objection commonly urged against ventricular puncture and the withdrawal of large quantities of fluid is the great loss of albumin. The author thinks that the loss of albumin (1 per cent in the cerebrospinal fluid), which would amount to about 10 gm. after each tapping, can be easily made up by the administration of proteids. As soon as the accumulation of fluid ceases to be large, the loss of albumin becomes less. Regarding the danger of infection, he believes it to be insignificant when proper precautions are taken. Authors express a fear of many punctures, because of the supposed damage to the brain. His answer is that in the many cases which he has tapped he has not yet seen an injury. Finally, he replies to the criticism that he is creating a negative pressure by contending that this is rather beneficial, as all closed lumina are thereby opened up and are thus prepared to take up the fluid so soon as the pressure rises. He attributes the failures of his critics to infrequent and insufficient tappings. The directions for the treatment of hydrocephalus in children he summarizes thus:

"1. In open skulls ventricular puncture should be done from the existing open spaces.

"2. The actual pressure should be measured at the beginning and at the end of a puncture.

"3. In serious cases withdraw during the first tapping about 100 c.c. of fluid, so that the pressure is lowered by about 20 c.c. water, but do not go below 5 c.c. The next tapping may reduce the pressure to zero, and still later tappings may bring the pressure down to minus, provided no unpleasant results are produced.

"4. Punctures should be repeated so soon as positive pressures are suspected; if necessary, daily; otherwise, after a few days, or until the skull circumference attains normal dimensions.

"5. In negative pressure, and when the cranial bones stand apart, use compression.

"6. Lumbar puncture should be done in the mild open skull cases; in the serious cases, only when improvement by ventricular puncture has already taken place, and it has again become necessary to remove large quantities of fluid.

"7. The more nearly complete the skull closure, the greater precautions must be used to prevent negative pressures.

"8. In a completely closed skull negative pressures must be altogether prevented. Do not cause a large reduction of pressure in one sitting, but tap frequently and withdraw small quantities at a time. If nothing can be accomplished in this manner, make a small trephine opening in the frontal region and establish permanent drainage.

"9. Only after persistent and energetic punctures have failed to relieve should the more complicated operations be resorted to."

Dandy, the originator of ventriculography, has described a still newer method for the treatment of hydrocephalus.

First, he localizes the occluded foramina causing the hydrocephalus. This he does by removing completely the ventricular fluid and substituting for it air. In obstruction of the aqueduct of Sylvius, the third ventricle will be clearly shown, but not the fourth ventricle. If the fourth ventricle and aqueduct of Sylvius are filled with air, the boundaries of each will be enlarged and sharply defined, thus eliminating an obstruction at the sylvian aqueduct. The obstructive hydrocephalus itself is demonstrated by the color test, which consists in the injection of indigocarmin into a lateral ventricle, which color must later appear in the spinal fluid, unless the case is one of obstructive hydrocephalus, either at the aqueduct or at the foramina of Luschka and Magendie.

Secondly, having determined that the seat of obstruction is at the last-named foramina, he makes an opening between the fourth ventricle and the cisterna magna, intended to take the place of the three openings which are blocked.

SEROUS MENINGITIS

(*Idiopathic Internal Hydrocephalus*)

Introduction.—This disease may be defined as a low-grade inflammation of the soft membranes, characterized by an edematous exudate into the subarachnoid space and the ependyma of the ventricles. Some have considered the process an ependymitis causing a serous effusion into the ventricles, and have compared it with a serous pleurisy. There are two varieties of the disease, the acute and the chronic type, each differing in symptomatology. Here I shall only describe the acute variety, the chronic type having already been discussed under Hydrocephalus.

Etiology.—Children or young adults are most frequently affected. There is commonly elicited a history of infection, such as typhoid, diphtheria, influenza, pneumonia, scarlet fever, or only tonsillitis, rheumatic sore-throat, or plain "cold."

Symptoms.—The symptoms may appear quite suddenly and resemble

those of the purulent types of meningitis. The usual onset is more subacute and the symptoms are of less intensity. There are fever, headache, rigidity of the neck, and Kernig's sign. Congestion of the nerve-head is the rule, and even pronounced choked disk is occasionally observed. The fever is not high as a rule, and is subject to great fluctuations; temperatures above 102° are but seldom seen. As a result of brain pressure we have delirium, stupor, and convulsions, all of which symptoms may quickly disappear with the absorption or emptying of the fluid. Palsies of the various cranial nerves may also appear and disappear, depending likewise upon the amount of fluid present.

Prognosis.—Many cases recover spontaneously; others die in spite of treatment. The duration of the disease may last weeks and months, but recovery seems possible at any stage. In a number of cases the acute gradually merges into the chronic form and is then indistinguishable from chronic hydrocephalus.

Differential Diagnosis.—The two conditions for which this disease is constantly mistaken are the ordinary purulent meningitis and brain tumor. A bacteriological examination of the lumbar fluid will differentiate the meningitis forms; but a careful study of symptoms is necessary in order to exclude brain tumor. In fact, one cannot always be certain that both are not present. Every clinician of experience has met cases in which he was unable, for a time at least, to come to a decision as between so-called serous meningitis and brain tumor. For the details of brain tumor diagnosis the reader is referred to the chapter devoted to its discussion.

Treatment.—It was Quincke's great merit not only to have discovered a method whereby we are enabled to differentiate the various types of meningitis by merely tapping the spinal fluid and subjecting the same to microscopic examination, but he has also given us a means of treating the disease which he first described. Removal of the cerebrospinal fluid, mostly always under great pressure, is the most efficacious treatment. Unfortunately the fluid but too rapidly reaccumulates. Quincke also recommends the internal administration of mercury and the external application of counterirritants to the scalp. Essentially the treatment is identical with that given for hydrocephalus.

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CHAPTER XXII

SYPHILITIC DISEASES OF THE BRAIN

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Introduction.—Syphiloma, or so-called gummatous neoplasm, has already been discussed under the caption of Tumors of the Brain. In this chapter we are principally concerned with genuine syphilitic brain affections originating from arteries and membranes.

Pathological Anatomy.—The most frequent type of brain syphilis is the variety called basal gummatous meningitis. In this form the inflammation usually begins in the subarachnoid tissues in the region of the optic chiasm—the interpeduncular space—and extends either toward the anterior or the posterior portion of the brain. The affected membrane has a peculiar spotted appearance, owing to the varying consistency and discoloration of the inflammatory products. The tendency is for the specific process to extend deeply into the fissures and to become intimately connected with the cranial nerves. Particularly the optic and oculomotor nerves become interwoven with the gummatous exudate, are compressed thereby, and appear studded with little swellings. In many cases, however, the cranial nerves are not implicated. It is the large arteries at the base of the brain which show a special tendency to become involved in the gummatous process. The arterial coats become thickened by the infiltration of diseased material, which causes a narrowing of their lumen in spots, the so-called luetic endarteritis.

Apart from the type of diffuse meningitis just described, there are found circumscribed gummatous masses in the neighborhood of one or more cranial nerves. It is also possible for the meningitic process to be localized in one spot, as, for instance, over the oculomotor nerve or the optic chiasm. The characteristic of syphilis of the brain, however, is its tendency to appear simultaneously in several locations. This fact explains the varied symptomatology of brain syphilis. Not infrequently hemorrhages and gummatous swellings are found side by side or in different parts of the brain. Diffuse softening of large brain territories has also been encountered along with the other pathological changes.

The syphilitic deposit must be considered a form of granulation tissue, a so-called granuloma, which caseates in some parts and becomes converted into fibrous material in others. In addition small-celled infiltration is found in the adventitious tissue of the arteries, also in the epineurium, particularly of the optic and oculomotor nerves.

Although not as frequent as at the base, a meningitic inflammation, either diffuse or circumscribed, may be found on the convexity, extending for some distance down toward the base of the brain. Indeed, it is possible for the syphilitic meningo-encephalitic process to cause softening of an entire convolution and even of a complete hemisphere.

A gummatous neuritis, particularly of the optic and oculomotor nerves, has rarely been observed. Syphilitic inflammation of arteries, without pathological changes in any of the other tissues of the brain, may also occur. The arterial thickenings of one or more insignificant branches of the basilar artery belong in this category. Many authorities assume that all forms of localized arteriosclerosis are of luetic origin. Oppenheim considers the finding of circumscribed softenings—not caused by diseased blood-vessels—a product of syphilitic encephalitis.

Etiology.—Syphilis of the brain has the same etiology as other forms of constitutional syphilis. During the past few years we have learned more of the true causation of syphilis than in all the previous years combined. In 1903 Metchnikoff and Roux, Neisser and Lassar succeeded in inoculating anthropoid apes with the syphilitic virus, thus enabling us to study experimentally syphilis and its poisons. Shortly after this epoch-making inoculation came the discovery of the *Spirachæta pallida* by Schaudinn and Hoffmann, which made possible exact studies of the character of all syphilitic processes, including congenital lues. Close upon the revelation of the actual cause of syphilis came the wonderful results of painstaking laboratory studies with the cerebrospinal fluid gained from syphilitics by lumbar puncture. Wassermann, Neisser, Bruck, Marie, Levaditi, Plaut, Citron, and others have contributed greatly not only to our theoretical knowledge, but also to the practical clinical diagnosis of syphilis, by the discovery and practical application of a specific serum-reaction, the so-called Wassermann test. It must not be inferred, however, that all our diagnostic difficulties have been removed. Spirochetes are not always found in syphilitic products, nor in all stages of syphilis. In addition the specific reaction of blood and cerebrospinal fluid is not constant, so that a negative test does not mean that syphilis is absent. To complicate matters still further, some of the reactions, cytological and chemical, as well as the positive Wassermann test, are found in the parenchymatous forms of syphilis, tabes and general paresis.

Several observers (Lavallé, Brosius, Nonne, Erb, and others) maintain that there is a distinct form of syphilis affecting the nervous system

by preference, which is caused by a so-called nerve-syphilis virus. This view is purely hypothetical.

The various manifestations of brain syphilis appear with greatest frequency within the first two years after infection, gradually becoming less frequent up to the tenth year. At the end of the tenth year after infection active nervous syphilis is rare, while postsyphilitic disorders are common. Exceptionally brain symptoms have appeared during the so-called secondary stage of the disease.

The development of cerebral symptoms in those having had syphilis is hastened by severe trauma, mental and physical stress, emotional causes, and alcoholism.

Symptoms—*Basilar Syphilitic Meningitis.*—The symptoms of this type show some uniformity in spite of the many variations which are met with. The patient usually suffers for some time from *headache,* an early and constant symptom of great importance. The headache may appear in paroxysms or is more or less continuous, becoming worse at night. In fact, the aggravated nocturnal cephalalgia is considered almost a pathognomonic sign of syphilitic as opposed to other forms of meningitis. Somewhat later attacks of *vomiting* and *vertigo* occur, and not rarely transient *losses of consciousness* and *general convulsions* appear. The patient's mentality is slightly weakened, showing a moderate degree of dementia; memory defects and general apathy are also commonly present. It is characteristic for syphilis that the stupor is not progressively increasing, as in brain tumor, but that at times the patient can be roused. Further, for hours or days a patient may be in a semicomatose state, which, upon superficial observation, does not differ from sleep or intoxication. There may be violent emotional outbreaks, attacks of confusion and even mania, alternating with perfect lucidity. Especially remarkable is the change from delirium to coma and the awakening from deep stupor to perfect rationality. With the preceding phenomena, the so-called general cerebral symptoms, paralytic signs may appear, pointing to implication of various cranial nerves.

In conformity with the usual seat of the syphilitic process at the base of the brain, the *optic and ocular nerves,* especially the oculomotor, will become affected. The paralysis or paresis may involve the entire oculomotor distribution or only some of its branches on one or both sides. The abducens and trochlear nerves are more rarely affected, the latter usually on one side. Quite frequently ptosis is the only symptom of third-nerve involvement. In many instances the branch controlling the pupillary phenomena is the only one affected throughout the disease; and even at the termination or recovery of cerebral syphilis pupillary rigidity may remain to tell the story. This internal ophthalmoplegia is rather rare in basal syphilis, but occurs more frequently in syphilitic arterial disease of

the brain. In bilateral involvement of the oculomotor nerve one side is usually more affected than the other.

Next to the oculomotor, the *optic nerve* is most frequently the seat of the disease. There may be present an optic neuritis or even typical choked disk, followed by atrophy. Occasionally an ophthalmoscopic examination still yields negative findings, while functional tests already indicate serious trouble. Homonymous or heteronymous hemianopia, that is, blindness in either the same-named or the opposite halves of the retinæ, may appear, to be soon followed by complete or incomplete blindness in both eyes. All of these visual disorders can be explained by the disease-process being localized at or near the optic chiasm at the base of the brain. When the optic nerve itself is the seat of the trouble we may have in addition concentric or irregular narrowing of the visual fields and central scotoma, that is, reduction of central vision.

In case the *olfactory nerve* becomes imbedded in the syphilitic deposit, we may have unilateral or bilateral anosmia, that is, loss of smell in one or both nostrils.

Similarly, the *trigeminus nerve* gives rise to intense neuralgic pains, or the reverse, namely, anesthesia or hyperesthesia in the region of its distribution—depending upon whether the nerve is being irritated or compressed.

When the process extends to the posterior portion of the base of the brain the *seventh* and *eighth* nerves rarely escape. The facial paralysis is of the peripheral type and the auditory nerve affection produces both nerve-deafness and vertigo.

The symptoms of involvement of the nerves springing from *pons* and *medulla* need no detailed description, as they correspond to those produced by non-specific causes.

As has been previously stated, there is no regular order in the appearance of symptoms. With the possible exception of certain forms of tuberculosis of the brain we know of no other condition in which this irregularity and inconstancy are so marked a feature. In fact, the most typical and constant factors in syphilis are atypicity and inconstancy. Take, for instance, the visual symptoms. One day a patient will have normal vision, the next day his visual fields are contracted—the day following his fields are again normal. Likewise, attacks of transient hemianopia, temporary and recurring blindness, with or without choked disk, are not unusual. And similarly we are not surprised to see fleeting ocular palsies passing through several cycles, that is, they may appear, disappear, and reappear, to again disappear, occur, and recur.

Vascular Type.—From the clinical and therapeutic point of view this variety of brain syphilis is even more important than the preceding one.

The most prominent symptoms occur as the result of occlusion of

blood-vessels, syphilitic infiltration of the vessel wall favoring clotting within its lumen. Symptoms pointing strongly to arterial thrombosis are hemiplegia and aphasia.

Syphilitic hemiplegia presents features similar to those of hemiplegia from other causes. Paralysis may be either slight and incomplete, or it may be severe and complete. Certain antecedent phenomena of the attack suggest its syphilitic character. First, as regards the *onset.* This is rarely accompanied by loss of consciousness. The patient perhaps notices as the first sign of approaching paralysis a weakness in the leg, followed by loss of strength in the arm and a drooping of the angle of the mouth. Secondly, a symptom frequently encountered in syphilitic thrombosis is more or less *severe headache,* which almost invariably *precedes the hemiplegia* by days or even weeks. But no sooner has the "stroke" occurred than the headache disappears as if by magic, or at least becomes considerably milder. So much have I learned to value the importance of the last symptom that I frequently make a provisional diagnosis of syphilitic thrombosis if I can elicit it in a young or middle-aged individual. This symptom is all the more valuable, as from the therapeutist's point of view the early recognition of syphilis is of immense importance—proper antisyphilitic treatment may prevent irreparable damage to the delicate brain structures.

As in the meningitic variety of brain syphilis, paralysis occurring from vascular disease may be either temporary or permanent. To explain the transient palsies we assume a temporary ischemia or localized anemia of the nerve centers, while the monoplegias or hemiplegias that have a tendency to become permanent are probably caused by vascular thrombosis. In the last type of cases we may have various sensory warnings, such as tingling and numbness in the extremities about to be paralyzed; in the transient palsies, however, such warnings are rare or do not occur.

Syphilitic endarteritis is capable of producing hemianesthesia, aphasia, cortical hemianopia, and bulbar paralysis, depending upon the vessel which becomes diseased. The middle cerebral artery and its branches being most frequently affected, hemiplegia and aphasia are common symptoms, but the basilar artery and its tributaries may also be rarely involved. In the latter event we will encounter the symptoms of posterior cranial nerve involvement.

In syphilitic disease of the *convexity* of the brain we have a series of characteristic phenomena pointing to its location. Among these, convulsions, followed by paralysis, indicate the existence of either gumma or inflammation. Localized syphilitic meningitis of the convexity may produce partial or *focal epilepsy.*

If the lesion is on the left side *aphasia* may result, with or without slight attacks of monoplegia or hemiplegia. Aphasia may also be caused

by thrombosis of the vessels nourishing the speech centers. There is no distinct type of speech disturbance characteristic for syphilis; motor, sensory and mixed varieties of aphasia may appear as in non-specific cases. It is important to remember that, as in the other symptoms of brain syphilis, variability and atypical character are leading features and aids in diagnosis.

Mental symptoms occupy a prominent place in the symptomatology of meningitis of the convexity. Depending for the most part upon the location of the inflammation in the frontal lobe, the symptoms may present striking resemblances to general paresis, for which it has often been mistaken. This syndrome has been described by writers under the heading of pseudoparesis and will be discussed under the differential diagnosis of general paresis.

Diagnosis.—In the majority of cases this is not difficult. We must consider: (1) the history or evidence of past or present syphilis; (2) the symptoms themselves—their character, development, and particular grouping; (3) serodiagnosis.

1. *Antecedents.*—A searching inquiry into the patient's antecedents will often lead to the desired goal. If no information is obtainable by questioning, the patient's body should be carefully examined for evidences of the disease. Syphilids may still be found, or else pigmented scars, with the parchmentlike, cigarette-paper appearance, may obtrude themselves upon the examiner's notice. It is also desirable to look for nodes on skull, sternum, and tibiæ. Fritz Lesser has emphasized the necessity for examining the base of the tongue for the so-called smooth atrophy, which indicates past syphilis. The finding of perforations in palate or nasal septum and of choroiditis will also be helpful.

2. *Symptoms.*—The symptoms themselves are characterized by a peculiar irregularity and non-conformity to types of organic disease. Symptoms may appear bilaterally, or may change from place to place in quick succession. Certain groupings of symptoms may direct attention to the syphilitic pathology. Thus we may have paralysis of the facial and auditory nerves of one side from periosteal swelling around the internal auditory meatus, or paralysis of the oculomotor nerves and the fifth, from disease near the cavernous sinus or the sphenoidal fissure. There may be paralysis of the bulbar nerves, such as the hypoglossal and spinal accessory, when the disease is a posterior basal meningitis. Transient palsies, localized twitchings and convulsions, with mental symptoms, are fairly characteristic for brain syphilis; also a peculiar state of apathy and drowsiness, alternating perhaps with wakefulness and severe nocturnal headaches. The somnolent condition is peculiar in that the patient may be roused when urged, yet he soon relapses into stupor. This state may last for days, perhaps to disappear and reappear. There are not

many diseases other than syphilis in which several organic lesions arise simultaneously in widely different parts of the brain.

3. *Serodiagnosis.*—The Wassermann test, if positive, will be of considerable assistance in diagnosis when there is doubt regarding the specificity of a certain brain lesion. It must be remembered, however, that the positive finding does not indicate that a particular brain disturbance is necessarily syphilitic in origin—it merely proves that the patient at some time in his life had acquired the disease. Further, its great limitation for our purpose lies in the fact that it is a general reaction for syphilis and does not attempt to state which organs are affected. A patient may be suffering from a glioma of the brain and also give a positive reaction in his blood, provided he is still syphilitic. As is well known, only the positive Wassermann is of value in diagnosis. Negative findings, therefore, do not exclude the existence of syphilis either in the active or latent form.

The *spinal fluid* shows an increase of lymphocytes, so-called lymphocytosis, in many cases of cerebral syphilis. Nonne's globulin test will be found positive in a large number of cases; also Noguchi's butyric acid test. Lange's colloidal gold test has a certain diagnostic value in brain syphilis, though not as great as in general paresis.

Prognosis.—Syphilis of the brain will always be considered the most serious form of the disease. About one-half of all cases die within two years of its onset, and one-fourth of all cases recover completely, while the remainder only improve. How long either the cure or the improvement will last nobody can foretell in any case. The outlook is especially doubtful in patients past the age of forty years.

It will be readily surmised that the more energetic the treatment and the earlier it is begun the better will be the prospects for recovery. According to the experience of those who have seen much of this disease, large gummata and sclerotic forms of syphilis are least amenable to recovery or improvement.

Singling out the various types of the affection, it would appear, according to Hjelman, quoted from Henschen, that cases accompanied by irritative symptoms, such as the epileptic forms and the basilar types of the disease, offer the best prognosis—71 per cent of the cured cases belong to this group. Hemiplegic forms with psychotic manifestations usually have a grave prognosis. The prospects for recovery in the hemiplegic cases will depend largely upon whether the paralysis is caused by cortical or capsular foci—if by the former the prognosis is more favorable. Syphilitic aphasia, unless due to vascular spasm, or temporary arterial occlusion, is often permanent, especially when accompanied by paralysis. The pathology is usually more or less complete destruction of Broca's center. At this point it may be well to state that the fallacy still prevails in the profession, that all syphilitic affections are amenable to cure, provided one applies proper antisyphilitic remedies. Nothing is further

from the truth. When softening of the brain has once occurred, it matters little what caused it, the disease must be considered incurable. Nor can an optic atrophy ever be restored, though it may have been produced by a syphilitic meningitis. The period for action is before complete destruction and atrophy have occurred—only then can we reasonably hope to start the processes of absorption, which, by removal of exudates, relieve the symptoms.

Even after complete recovery has occurred patients are not free from relapses, so-called "neurorecidives," under which name they have been frequently described by the Germans in connection with the administration of arsphenamine injections.

Prophylaxis.—The prevention of brain syphilis, to which disease so many young and middle-aged men fall victims, is essentially the same as that of syphilis in general. The ignorance prevailing on matters sexual is alarming; it is surprising how many educated young men unthinkingly throw themselves into the arms of those capable of transmitting this disease. If the laity were more thoroughly instructed regarding the far-reaching consequences of a single infection, brain syphilis would possibly not occur with such alarming frequency.

After syphilis has been acquired the prophylaxis against brain involvement must consist in a most energetic specific treatment, carried on consistently for a period of three years. The patient must remain under the physician's observation for at least five years longer, during which time he is to be frequently examined for the development of the first suspicious signs of nervous syphilis. A constantly recurring fact, while examining syphilitic brain cases, is the finding that the majority of them had either received no treatment at all or only an insufficient amount of it during the early periods of the disease.

My experience of over thirty years with a large number of cases of nervous syphilis, both in private and hospital practice, has convinced me of the importance of early and energetic treatment of syphilis, although it must be admitted that occasionally an individual may develop a fulminant type of nervous syphilis while under treatment by a competent physician. These cases are so rare that they constitute notable exceptions. The fact remains that the great majority of cases coming to the neurologist's notice have either not been treated at all, or insufficiently so, and for too short a time, when the first manifestations of syphilis appeared. The fault may not altogether be ascribed to the patients. Perhaps physicians do not sufficiently emphasize the dangers awaiting a syphilitic. Each patient should be told that, although there is no absolute safeguard to prevent the worst forms of syphilis from making their appearance at a later stage, yet the only known measure against such occurrence is radical and prolonged treatment early in the disease. I further believe that patients affected with syphilis should never be dis-

charged as cured until they have been under uninterrupted observation for about five years after all symptoms have disappeared, and when the Wassermann on blood and spinal fluid has repeatedly proved negative in the hands of competent laboratory workers.

Another prophylactic measure of vital importance is the absolute prohibition of marriage to one who has had syphilis. If this command must be broken the individual should have been free from symptoms for five years, and repeated examination of spinal fluid and blood must have been negative.

In those syphilitics who are predisposed to nervous disorders strict mental hygiene should constantly be insisted upon. It is well known that nervous syphilis especially attacks individuals who have either inherited a weak nervous system, or who have become debilitated by unhygienic habits. Unfortunately, inherited mischief cannot be remedied—all the more must patients be impressed with the necessity of saving their mental energies by avoiding intellectual overexertion and emotional storms. Not rarely brain syphilis develops after some great psychic perturbation, which evidently had created a point of least resistance. Alcoholism is another factor favoring cerebral lues by the chronic hyperemia which it produces, thereby weakening the cerebral tissues. In the same category belong sexual excesses, insufficient sleep, and improper diet. As gumma of the brain or syphilitic meningitis often develops after severe trauma, and as we are forced to recognize the important rôle that injuries to the head in general play in provoking cerebral lues, syphilitic patients should relinquish occupations exposing them to head trauma of any kind.

TREATMENT

When the diagnosis, syphilis of the brain, is definitely established, energetic antisyphilitic treatment must be instituted without delay. Inaction often spells irreparable damage to the delicate nervous tissues.

While the treatment of nervous syphilis does not differ essentially from that of syphilis in general, yet certain methods have been recently developed which aim to attack the disease locally. After the laboratory and clinical diagnosis of cerebral or cerebrospinal syphilis has been definitely made, it is quite essential to search out the regional peculiarities of the disease before deciding on a plan of action. The treatment should take as its starting point the new clinical division of syphilitic nervous diseases into: (1) *interstitial* types, which include most of the lesions previously classed under cerebrospinal syphilis; (2) *parenchymatous* types, which comprise the group of diseases formerly known as parasyphilis, postsyphilis, or metasyphilis, with tabes and general paresis as conspicuous examples; and (3) *vascular* syphilis and its numerous accidents.

The most favorable results from treatment are recorded for the interstitial variety of nervous syphilis, improvement being noted both in the biologic reactions and in the clinical findings. This improvement is best explained by the local peculiarities of the lesions, which consist for the most part of edema and pressure on nerve centers, but not of destruction of the nerve parenchyma. Provided nerve tracts and centers have been spared the ravages of spirochetal activity, the cures of this variety are occasionally next to perfect. For the same reason, the treatment of parenchymatous syphilis is not nearly as satisfactory—the beneficial results being limited mostly to the removal of symptoms produced by the inflammatory and exudative processes also present in this variety. Least favorable for therapeutic efforts is the third group, so-called luetic endarteritis, in which the blood and spinal fluid frequently show negative findings, while the patients present the worst examples of thrombotic softening of the brain and spinal cord. Improvement, if it occur at all, is proportionate to the degree in which the endarteritis and its consequences can be influenced.

The drugs at our command in the management of nervous syphilis are, in the order of their importance, mercury, arsphenamin or neo-arsphenamin and iodids.

Mercury.—This classical remedy, which still is, and probably will remain so for a long time, our most effective weapon in the fight against syphilis, may be administered in various ways: by the mouth, in the form of pills or solutions; by the skin, in the form of inunctions or fumigations; by injection, either intravenously or intramuscularly.

The treatment by means of the well-known "little pills" belongs to the past. Nothing was ever more delusive and disastrous of results in a negative way than the fond hope that a patient was being treated when he was only playing with treatment. To this so-called treatment may be charged the development of many cases of tabes and paresis, which parenchymatous diseases of the nervous system were permitted to germinate and reach full growth while the patient was supposedly under his physician's care. For reasons that are obvious, progressive physicians everywhere have discarded the routine administration of mercury by mouth. There are but very few occasions left in which this form of mercurialization may still be recommended.

The most effective and most readily applied form of mercurial therapy is by inunction. The inunction method consists in rubbing into the patient's skin a varying amount of mercurial ointment—an average dose being considered from 1 to 2 drams (4 to 8 gm.). This quantity is placed in a waxed paper and the patient is directed to rub its contents into the body, selecting a different part for each subsequent rubbing. After twenty minutes' to one-half hour's rubbing the ointment will probably have

disappeared and a piece of flannel bandage may then be tied around the part, which is to remain there during the night. The parts chosen for this purpose are the flexor surfaces—groins, bends of elbows, the popliteal spaces, and the inner surface of the thighs. To facilitate absorption of the ointment, the skin is made more supple by the taking of a lukewarm bath before each rub and of a full hot bath every fourth night. Thirty rubs constitute a course of treatment. Between each mercury course a period of iodid administration is interposed. The iodid of potassium or sodium is prescribed in doses, beginning with 30 drops of the saturated solution, gradually increased to 1 dram (4 gm.), three times daily after meals, taken in liberal quantities of milk or water. Having taken iodids for a period of four weeks, the mercurial rubs are again resumed and another course of treatment is finished. The iodids are again administered and alternated with courses of mercury. These regular alternations may be persevered in during the entire period of active treatment, or the so-called "mixed" treatment may be substituted. The latter consists in the simultaneous exhibition of mercury and iodids during a period of six weeks, followed by complete cessation of treatment for another six weeks. During this interval the patient is ordered to take a generous and unrestricted diet, tonics and rest. At the expiration of this resting period treatment is again resumed and another rest is followed by treatment. This is carried through alternately with periods of rest during one to two years, depending on how rapidly the Wassermann test in both blood and spinal fluid can be made and kept negative.

A good substitute for the ordinary mercurial ointment, which is unsightly and apt to "tell a story," has been found in oleate of mercury, which is comparatively cleanly and produces results as rapidly as other preparations of mercury applied to the skin. A dram (4 gm.) of the 10 per cent oleate of mercury is used night and morning for four days. Thereafter the same dose is continued only once daily for four days more. If no evidence of salivation has appeared, the double dose may be resumed; otherwise we return to the single dose. The oleate is rubbed into the skin by means of a piece of flannel which may be used continuously, selecting for each application a different portion of the body. While irritation to the skin may also occur from the oleate, it has the advantage of permitting absorption to take place more readily from all parts of the body than is possible with the blue ointment. A course of treatment lasts six weeks, the same as with unguentum hydrargyrum. Rubbings may be alternated with the iodids, or both may be ordered conjointly.

Mercurial Injections.—The treatment by injections of mercury is intended to deliver a more concentrated and energetic blow to the spirochetes. The choice of the mercurial salt, whether soluble or insoluble, is merely a matter of convenience; whereas the soluble salts must be injected daily or at least every other day, the insoluble mercurials need

not be injected oftener than once or twice weekly. Though well known on the continent of Europe, the injection of mercury is comparatively new with us. Of all forms of mercurial administration this should be the method of choice in all serious nerve lesions of syphilis, for by no other route, save perhaps the intravenous, can mercury be forced more rapidly into the general circulation. In those instances injections may be administered daily or even twice daily of the soluble salts, biweekly of the insoluble ones. In fulminant types of nervous syphilis, and when the disease has assumed widespread proportions, we may advantageously flood the system with the soluble salts of mercury.

Injection therapy, which is practically always given intramuscularly, requires that certain precautions be observed. Regardless of which preparation is being used, careful asepsis must be maintained with reference to needle and syringe, patient's skin, and physician's hands. Blood-vessels should not be perforated and piercing of nerve trunks is to be avoided. The buttocks have become the favorite site for intramuscular injections. The exact spot of preference is the center of a line drawn from the anterior superior spine of the ilium to the upper end of the intergluteal fold, this point being well above and to the outer side of important vessels and nerves emerging from the pelvis through the great sacrosciatic foramen. The most commonly used soluble mercurials are the bichlorid, succinamid, and the oxycyanid of mercury, in doses varying according to the severity of the case, from $\frac{1}{8}$ to $\frac{1}{2}$ gr. (0.0075 to 0.03 gm.), injected daily into the buttocks to a depth of about 5 cm. A course of treatment consists of thirty injections, which may be repeated after a longer or shorter interval, depending on how soon the Wassermann test on blood and spinal fluid becomes negative.

Of the insoluble salts of mercury, the most important and most generally useful is the so-called "gray oil" (National Pathological Laboratory), which is given in doses of approximately 1 gr. (0.06 gm.) once or twice weekly, injected deeply into the buttocks. The insoluble forms of mercury, after being deposited in the muscles, undergo slow absorption and thus continue to feed the body with small doses of mercury. As the rate of absorption is not within our control and varies considerably in different individuals, we examine frequently for signs of beginning salivation. On the first appearance of reddened or spongy gums and of the peculiar mercury breath, injections are discontinued. Indeed, it is a good rule to interrupt the treatment after each series of eight injections, in order to study the possible development of mercury poisoning in the patient.

Mercury, irrespective of preparation or method used, requires scrupulous attention to the oral cavity. The teeth and gums should be thoroughly brushed after each meal with powdered chlorate of potash, and the mouth rinsed with a 3 to 5 per cent solution of the same substance, or listerine

and similar antiseptic mouth washes may be used. Needless to add that all articles of diet containing even a trace of the mineral or organic acids should be excluded, which means also raw and cooked fruit. Neglect of these precautions is most likely to produce salivation, which necessitates the interruption of treatment.

Arsphenamin, Neo-arsphenamin and Silver-arsphenamin.—The methods of administering these spirocheticides being well known, I shall limit myself to a discussion of their special applicability to the treatment of nervous diseases.

When arsphenamin was first given to the profession, we believed that it possessed death-dealing qualities against the spirochetes, provided the attack was directed against their early lesions. Ehrlich himself warned against the use of arsphenamin in the very late lesions and especially in diseases of the central nervous system, in which he advised the experimental use of small doses of the remedy cautiously repeated. It appears quite probable that, largely on account of the small doses administered, many of the spirochetes situated in the outlying districts of the nervous system which escaped the destructive action of arsphenamins began to multiply at an enormous rate and shortly produced the disagreeable relapses called neurorecidives or neurorecurrences. Many controversies as to the true nature of these unforeseen accidents were carried on, and progress for a time at least was retarded. Fortunately for the advancement of this form of therapy it was found later that additional larger doses of arsphenamins, administered after the development of these nerve accidents, had a tendency to cause the disappearance of the symptoms. At about the same time it had been discovered that arsphenamin or neo-arsphenamin combined with mercury was more effective than when either of these remedies was administered alone. When finally the biologic proof was brought that all forms of this disease are real syphilis, not merely somewhat related to it, hopes were entertained that all syphilis would be treated alike. This was found to be a mistake. Because certain early syphilids yield readily, within a very short time, to one or two injections of arsphenamin, is no proof that cerebrospinal syphilis will be cured in the same way. On the contrary, it has been positively demonstrated that the late and deep-seated lesions of syphilis, especially those of the central nervous system, require repeated, fair-sized doses to bring about results. In conformity with this reasoning Collins and others have adopted what they call the "intensive" intravenous method of treating nervous syphilis.

This method aims to flood the system with arsphenamin or neo-arsphenamin intravenously, only two days being allowed between injections, of which five are administered, unless there are contra-indications. During the intervening days between injections the patient receives inunctions of mercury, or he is given injections of the salicylate of mercury

in ½ to 2 gr. doses (0.03 to 0.12 gm.), or the mercury bichlorid in doses of ⅛ to ½ gr. (0.008 to 0.03 gm.) is injected intramuscularly every day or every second day. After treatment lasting three or four weeks a laboratory examination of blood and spinal fluid is made, which decides whether treatment is to be continued. Usually the series of injections is repeated after three months. This plan of treatment is consistently adhered to until all evidence of syphilis has disappeared from blood and spinal fluid.

Though the "intensive" treatment had been adopted by many clinicians, and good results were not rare, yet numerous observers felt dissatisfied with the slow progress obtained from this rather heroic treatment. Besides, relapses were as common as under the old line of treatment. Nothing was more natural, therefore, than to conclude that there must exist some anatomical barrier to the free transmission of arsphenamin from the general circulation into the central nervous system. And indeed several observers have actually furnished the experimental and clinical proof that little or no arsphenamin enters the subarachnoid space. According to Goldman and others, the choroid plexuses, which constitute the great source of the spinal fluid, functionate somewhat like a filter, in that certain poisons, arsphenamin and neo-arsphenamin among them, are not allowed to pass into the ventricular system, while the fluid elements are given free passage. Though this peculiar arrangement serves as a great defensive measure against the entrance of poisons into the nervous system, it also prevents the entrance of needed remedies. It must be considered a triumph for therapeutic resourcefulness, therefore, when Marinesco, Robertson, and particularly Swift and Ellis, who all carried on similar investigations, thought of overcoming this disadvantage by an effort to reinject into the subarachnoid space the patient's own serum previously charged with a full dose of either arsphenamin or neo-arsphenamin. Thanks to the ingenuity of Swift and Ellis, an intraspinal therapy has been worked out which bids fair to revolutionize our entire treatment of nervous syphilis.

Swift and Ellis describe their method substantially as follows: The patient receives an intravenous injection of 0.5 gm. arsphenamin, given in the usual manner. One hour after this administration enough blood is withdrawn from the patient's vein to give at least 15 c.c. of serum. The blood, obtained under aseptic precautions, is permitted to coagulate, and is then placed in the ice-chest over night. Next morning the separated serum is very carefully decanted off into a centrifuge tube, and permitted to centrifuge for about half an hour. The clear supernatant fluid is pipetted off from the few red cells at the bottom, and poured into a graduated cylinder up to the 12 c.c. mark, and then brought up to 30 c.c. by the addition of sterile 0.9 per cent NaCl solution. This is placed in a 56° C. thermostat for thirty minutes, and the mixture of serum and salt is ready for intraspinous injection.

The solution is injected at body temperature. With the patient lying on his side, in bed, near the edge, the back is rendered aseptic. The area to be punctured may be anesthetized with 2 per cent sterile novocain solution. The lumbar puncture needle is introduced in the usual manner, and about 30 c.c. of cerebrospinal fluid is withdrawn, or a quantity that will reduce the intraspinous pressure to about 30 or 40 mm. This is gaged with a 3 mm. glass tube graduated in centimeters and millimeters. When the desired pressure is reached, the connection with the gage is discontinued. The serum-salt mixture is poured into a Luer syringe (large size), carrying at the delivery point a sterile piece of connecting rubber tubing about 12 inches long. This tubing is then attached to the lumbar puncture needle, taking care not to introduce air; the mixture is now permitted to flow gently into the subdural space. The use of a gage is not essential, the only requisite being that the quantity removed equal the quantity introduced. If the patient complains of discomfort, the further withdrawal of fluid had best be stopped, and the mixture introduced before the 30 c.c. have been withdrawn. The patient is then allowed to remain in bed twenty-four hours; in order to facilitate the mixing of serum and spinal fluid, the foot of the bed is elevated about 6 inches, while the pillows are removed from under the head. As a rule the after-effects are mild, the patient experiencing perhaps some headache; in many instances pains in the lower extremities are felt, in others there may be a feeling of dizziness and perhaps slight fever.

The autosero-arsphenamine intraspinal injection method of Swift-Ellis has been adopted by numerous clinicians in this country and in Europe, most of whom have published favorable reports from its use in syphilis of the nervous system, both interstitial and parenchymatous. The original technic as described by the authors has been followed by most men employing this method. But, like every new method, it is capable of modification. In this instance, slight modifications have been introduced both with reference to the time of blood-withdrawal and as to the dilution with normal salt solution. McCaskey believes that because the arsphenamine content is rather low an hour after the withdrawal of blood, *twenty minutes* is quite sufficient time to wait before withdrawing the blood. He thus aims to increase the arsphenamine content, having seen no ill effects from shortening the period. Because of its simplicity and efficacy this modification has found many friends, the writer of this article among them.

Another modification of the Swift-Ellis treatment consists in the method of injecting pure serum, undiluted with normal salt solution, but otherwise prepared according to the authors' directions, and in the prescribed quantities. My own practice is to use for the initial intraspinal injection 12 c.c. of undiluted serum prepared according to Swift-Ellis, which dose I increase gradually with each injection—15, 18, 20, 25, and

lastly, 30 c.c. of undiluted serum. I have not seen any ill effects from this mode of intraspinal treatment.

Direct Intraspinal Injections.—A complicated technic such as the Swift-Ellis method demands is sure to bring forth numerous suggestions at simplification. All attempts were directed toward the introduction of arsphenamin and neo-arsphenamin into the subarachnoid space directly without being under the necessity of first giving an intravenous injection. Wechselmann was the first to inject a small amount of arsphenamin intraspinally. He was followed by Marinesco, Ravaut, Schubert, Gennerich and Wile. Not until Wile had published a concise description of Ravaut's method of direct intraspinal medication had this method been tried to any extent. But no sooner had it become popular, when we began to hear all kinds of unfavorable reports, partly due to defective technic, but mostly to inherent faults of the method itself. Against it must be mentioned the production of paralysis of the legs, bladder and rectal sphincter as well as decubitus and death. Attracted by the simplicity of this procedure I have given this so-called short cut to success an adequate trial in my hospital work, but like Corbus, Gordon, Sachs, Strauss and Kaliski, I have had unpleasant experiences. Not that I could not record an occasional brilliant result in an almost hopeless case, but the failures were too many and apparently the result of the treatment. For the present at least, the verdict is against direct intraspinal injections of arsphenamin and neo-arsphenamin. Most of us have already returned to the more complicated—but far safer—autosero-arsphenamine therapy of Swift-Ellis.

Ogilvie's Method.—One of the important contributions to intraspinal therapy is that furnished by Dr. Ogilvie, who devised a method of adding small amounts of arsphenamin to human serum, prepared according to Swift-Ellis without a previous intravenous injection of arsphenamin. The method aims to inject intraspinally a known dose of arsphenamin instead of being content with the uncertain quantity of the same remedy contained in a Swift-Ellis injection. While the reports from this treatment are rather encouraging, nevertheless the author sounds a note of warning not to exceed the dose of 1 mg., owing to the occurrence of temporary bladder disturbances from the larger doses. Fordyce goes even one step further, and thinks the dose of ½ mg. should not be exceeded, as unpleasant sequelæ have followed the first-mentioned dose. Swift, in commenting on this method of Ogilvie, admits its greater spirocheticidal effects as compared with his own method, but contends that a certain as yet unexplained principle derived from the patient's blood and probably the result of the action of arsphenamin on the blood constituents is lacking in the Ogilvie method, but present in his own procedure of injecting arsphenamin into the patient's blood before utilizing the serum.

Byrnes' Method.—This form of intraspinal therapy is similar to the

preceding and differs from it only in the fact that to blood-serum, prepared as for Swift-Ellis without the previous intravenous arsphenamine injection, there is added a small dose of mercury bichlorid instead of arsphenamin. Dr. Byrnes is under the impression that the beneficial results from the Swift-Ellis treatments are not derived from the infinitesimally small amount of arsphenamine contained in the 30 c.c. of diluted serum, but rather from the bichlorid of mercury still circulating in the blood and thus transferred directly into the subarachnoid space. He correctly reminds the reader that arsphenamine therapy is nearly always combined with energetic mercury medication and he therefore proposes the direct introduction of mercury into the subarachnoid spinal space in doses of from 1/50 to 1/25 gr. (1.3 to 2.6 mg.). Having tried this method quite extensively in my hospital practice, I am convinced of its efficacy in improving laboratory and clinical findings, but would discourage its further use because of the violent reactions it produces.

Intracranial Injections.—By this is meant the introduction into the cranial cavity of spirocheticidal substances either by subdural injection or by placing the remedy into the ventricles. For this purpose the sera prepared according to Swift-Ellis and Ogilvie, as well as Byrnes' bichlorid solution, have been utilized with varying success. Drew M. Wardner, who gave a detailed description of the intracranial method of injecting arsphenaminized serum, believes that the ordinary administration of either mercury or arsphenamin intravenously and intraspinally does not reach the brain. In his opinion, therefore, the treatment of spirochetal involvement of the cerebral structures must be applied directly to the brain. While there is truth in this statement, one must not forget that the method presents difficulties and has already resulted in fatalities. The writer of this article still urges conservatism in the application of a method as hazardous as intracranial injection.

Ayer's Intracistern Route.—Less dangerous and perhaps quite as efficacious is the route through the cisterna magna, first described by Ayer in conjunction with Wegeforth and Essick in 1919 and again by himself in 1920. According to the author, the procedure has been found almost always easy, and no alarming symptoms have been observed, either at the time of puncture or subsequently.

"The patient is placed on the side, as if for lumbar puncture, with neck moderately flexed. Care is taken to maintain the alignment of the vertebral column to prevent scoliosis and torsion. After antiseptic preparation of the skin, usually including the shaving of a little hair, and local anesthetization with procain, the thumb of the left hand is placed on the spine of the axis, and the needle inserted in the midline just above the thumb. The needle may be pushed rapidly through the skin, but should then be cautiously and guardedly forced forward and upward in line with the external auditory meatus and glabella, until the dura is pierced. If

the cisterna be entered at this angle there is usually a distance of from 2.5 to 3.0 cm. between dura and medulla as shown on frozen sections; with the needle less oblique in position the distance between the walls of the cisterna becomes progressively less. Therefore, it is good practice to aim a little higher than the auditory meatus, and, if the needle strikes the occiput, to depress just enough to pass the dura at its uppermost attachment to the foramen magnum. At its entrance the same sudden 'give' is felt as in lumbar puncture. The needle employed is a regular lumbar puncture needle, nickeloid, 18-gage preferred, with beveled stylet, sharp on the sides but not too sharply pointed. There is rather less variation in the depth of the tissue traversed than in the lumbar region, being in an ordinary sized adult from 4 to 5 cm., the greatest distance in the series being 6 cm. and the smallest 3.5 cm. It was found that a faint circular scratch on the needle, 6 cm. from the tip, was entirely satisfactory in judging the distance."

In spite of the simplicity of the technic, the author thinks it unfair to the patient to perform cisterna puncture without previous experience at the necropsy table.

Ayer himself utilized the intracistern route principally for diagnosis, at first, and only of late for the introduction of arsphenaminized serum (Swift-Ellis technic).

F. G. Ebaugh, following Ayer's technic, reports on a series of 250 punctures in 28 patients with the diagnosis of general paresis. He sees in this method a great advantage over intracranial injection because of the facility with which it can be performed; doubtless treatment is more intensive than by the intraspinal method—there is less dilution and more widespread dissemination of the serum. It seems that this method allows the serum to reach all areas of the brain, and syphilitic foci, whether of the interstitial or parenchymatous variety, come within its range.

Spinal Drainage.—Gilpin and Early in 1915 reported favorably on their method of treating neurosyphilis by means of mixed treatment, namely, mercury and intravenous injections of arsphenamin, followed by complete drainage of the spinal fluid. This method is based on the assumption that with a reduced intraspinal pressure the arsphenamin and mercury circulating in the patient's blood should more readily diffuse into the subarachnoid space. The technic is as follows: Immediately after an intravenous injection of any of the arsphenamine preparations a spinal puncture is made and fluid withdrawn until no more flows from the cannula. Spinal drainage should not be performed oftener than once in two weeks, though arsphenamine injections and mercury "rubs" may be continued as before. In order to prevent headaches, it is best to treat the patient at home or in a hospital, where he may remain in bed at least twenty-four hours, with head low and feet slightly elevated.

Dercum has done so much to popularize this method of treatment,

that it has become generally known as Dercum's spinal drainage. He believes this to be equal if not superior in value to the Swift-Ellis method of treating neurosyphilis—an opinion which the writer of this article is unable to share with him. On the contrary, he is more than ever convinced that the method of Swift-Ellis has gained a permanent place in the management of neurosyphilis, while spinal drainage has already been abandoned by many who gave it an impartial trial.

Iodid Administration.—Formerly physicians crowded the iodids, even up to 1,000 gr. daily. Now that we have a gage in estimating the spirochetal qualities of any drug by means of the several biologic reactions, it has been ascertained that for most forms of nervous syphilis the iodids can be dispensed with. Collins, Weisenburg, and Cotton, for instance, have come out against the use of the iodids altogether, and others are indifferent towards employing them. There are those who, like Jelliffe and myself, having had undoubted proof of the efficacy of iodid medication in the past, are loath to discard its use entirely. While we admit their low spirocheticidal power in attacking the interstitial variety of nervous syphilis, we must concede to the iodids the useful quality of absorption of inflammatory products, the result of microbic activity. It is still necessary to give fair-sized doses of iodids in all forms of vascular syphilis of the nervous system, in which group they have certainly celebrated great triumphs. In my opinion, the dose should not exceed 1 dram three times daily (4 gm.), largely diluted in water or milk, and taken after meals. Of course, the iodids constitute a necessary part of the so-called "mixed" treatment, but it is well to bear in mind that the very large doses are not more efficacious than the smaller doses and are more apt to upset the patient's gastric functions. In connection with other treatment I am still in the habit of giving 30-gr. doses (2 gm.) of sodium iodid three times daily.

Plan of Treatment.—Almost every clinician has his own favorite method and plan of treatment. All seem to agree that it is essential before beginning any treatment, and even during its continuance, to have the blood and spinal fluid examined for Wassermann, Nonne, and increased cell count. There is no more reliable guide in gaging the progress of treatment and learning something about the extinction of the syphilitic processes than the taking of an occasional inventory of the biologic reactions.

With reference to the use of arsphenamin or neo-arsphenamin, opinions are still divided. When the new preparation was first introduced almost everybody neglected the old arsphenamin, for the ease with which neo-arsphenamin can be injected had much to commend its use. After a short time, however, it was ascertained that arsphenamin is much more spirocheticidal than neo-arsphenamin and that it took many more injections of neo-arsphenamin than of arsphenamin to clear up certain of the

early lesions of syphilis. Then came a reaction in favor of arsphenamin and another favoring neo-arsphenamin. At present public opinion again favors neo-arsphenamin. Except for the dosage, there is no essential difference between the two forms of arsphenamin.

The question of the proper degree of dilution of arsphenamin and as to whether concentrated solutions are preferable to the large infusions can and should be decided by each clinician. Personally I have come to regard the dilutions in 200 to 300 c.c. of normal saline solution or distilled water as superfluous and in some instances productive of unpleasant reactions. I prefer in most cases to use very concentrated solutions, which have never given me occasion for regret.

How often shall an intravenous injection be given? In this respect there are also differences of opinion. Most physicians now advocate the "intensive" treatment, that is, the frequent repetition of injections at least in the beginning, widening the intervals later.

Can we rely on arsphenamin or neo-arsphenamin alone, or shall we employ the combined treatment with mercury, or is the mercury to follow or precede the arsphenamin? This can now be answered by the statement that arsphenamin and mercury given in combination constitute the most effective treatment to begin with. After a series of arsphenamin injections the mercury treatment is continued for an indefinite period with the usual intervals of freedom from all medication.

When shall the intraspinal injection of arsphenaminized serum be administered in the treatment of nervous syphilis? In the strictly cerebral interstitial lesions it is not at all necessary to resort to the Swift-Ellis treatment. However, in cerebrospinal lues of the chronic variety and especially in tabes the most effective assistance can be obtained from this method of treatment, provided the mercury is also given.

It will be inferred from the preceding statements that arsphenamin and neo-arsphenamin have proved our most efficient, and rapidly acting, agents in the fight against brain syphilis, but we must not forget that mercury in its various modes of administration has remained our faithful ally. Neither must we forget in our enthusiasm to render the Wassermann negative, that we are treating the patient, not the condition of his serum. The patient himself is not at all interested in the laboratory tests—as Craig and Collins so well put it—his is the search for physical and mental cure. It will be necessary, therefore, not only to administer directly antisyphilitic remedies, but to employ all the adjuvant measures with which we have so long been acquainted.

PROGRESSIVE PARALYSIS OF THE INSANE

(*Dementia Paralytica*)

Etiology.—The real cause of general paresis is syphilis, either congenital or acquired. With tabes the disease was formerly classed as a postsyphilitic disorder, for there is an appreciable interval of time between infection and the development of symptoms—ten or more years. On account of the supposed absence of existing specific lesions in brain and spinal cord, and because of the inefficacy of antisyphilitic medication, it was thought that the syphilis itself had disappeared, but had left behind toxins. This view had to be abandoned since Noguchi and Moore discovered the Spirochæta pallida in the brains of paretics and W. W. Graves succeeded in reproducing the lesions of syphilis in the rabbit's testicle after inoculation with the blood from paretics. If anything more were needed to establish definitely the true etiology of general paresis, one may cite the almost invariable presence of a positive Wassermann reaction in the blood and spinal fluid of paretics—a biologic reaction characteristic for syphilis. There may be contributing factors, such as chronic alcoholism, mental strain, or trauma to the head, but the essential cause is syphilis of the brain.

Pathology.—The cerebral convolutions, especially the frontal lobes, appear atrophied and the membranes are adherent and thickened. Numerous nerve cells have either disappeared or have become shrunken. There is loss of commissural and of tangential fibers. In many instances similar changes have been observed in the posterior columns of the spinal cord.

Symptoms.—The first evidence of general paresis usually appears in the mental sphere. The patient becomes irritable, unstable; he frequently alternates between depression and exaltation. The intellectual disturbances assume characters varying in different individuals. In many cases forgetfulness is noticed early by the patient's friends or family, particularly when it entails money losses. In one occupying a subordinate station in life mental deficits may for a long time remain unrecognized. There is scarcely a picture of mental disease which has not been reproduced by general paresis—from slight depression to the most violent attack of mania. These episodes are mostly of short duration and differ from the functional psychoses, which they simulate by their grotesqueness and absurdity. In doubtful cases the presence of physical signs enables a correct diagnosis to be made. Occasionally general paresis is ushered in with convulsions indistinguishable from those occurring in ordinary epilepsy. After each attack mental and physical deterioration becomes more marked. If the patient is a skilled mechanic he loses his dexterity and is compelled to abandon his work, although he may still be capable of performing coarse

labor. As a general rule the last acquired and least organized accomplishments are the first to disappear.

It will only be necessary to enumerate the most important *physical signs* of general paresis. They are: (1) pupillary inequalities, sluggish or absent light reflex (Argyll-Robertson pupil) in one or both pupils; (2) ocular palsies; (3) slight asymmetry (paresis) of face, tongue, or muscles of palate; (4) weakness in the lower extremities (slight hemiparesis); (5) speech disturbances; (6) disorders of locomotion: spasticity, ataxia, or paralysis; (7) sensory troubles (hypalgesia); (8) exaggeration, inequality, or absence of tendon reflexes; (9) sphincter paralysis; (10) optic atrophy.

The symptoms commonly observed when the patient is brought to the physician are the presence of unequal pupils, which fail to react to light, irregular tremors in lips, tongue, and hands, and peculiar speech disturbances. When the patient attempts to repeat test sentences, as "Round a rugged rock the ragged rascal ran," or "Peter Piper picked a peck of pickled peppers," "truly rural," "National hospital for the paralyzed and epileptics," he either forgets entire words or mispronounces and swallows whole syllables. During conversation his facial musculature, including the tongue, flickers and trembles. There are decided tremor and marked incoördination in hands and fingers when tested in the usual way, as by having patient spread his fingers, or touch his nose with the index finger. The handwriting likewise betrays tremor, incoördination, and general failure of the intellect. The deep reflexes may be entirely absent or unequally exaggerated. For convenience of description the symptoms have been classified into three groups and have been assigned to the three stages of the disease.

1. The prodromal symptoms, occurring in the incipient stages, are much like those of neurasthenia, except that here there are forgetfulness, lack of correct judgment, and a noticeable deficiency of tact.

2. The fully developed disease may appear either as exaltation (mania) or marked depression (melancholia). At one time hallucinatory excitement may be the prevailing mood; at another time all these states alternate and a circulatory psychosis may be simulated.

3. In the final stage the psychic outbreaks subside and a slowly progressive dementia develops, during which the patient is reduced to a vegetative automaton, requiring as much care as an infant.

It must not be forgotten that the division into stages is only schematic. One stage often merges imperceptibly into the other, and long remissions may occur between stages. At any stage the disease may be interrupted by apoplectic attacks, which are characterized by the development of transient hemiplegias and are sometimes accompanied by epileptiform convulsions, rises in temperature and loss of consciousness. The paralytic

attacks are usually mild, and the symptoms rarely last more than a few days.

Differential Diagnosis.—In the early stages the disease may be confounded with neurasthenia. In fact, for some little time a definite diagnosis may be impossible, but differences will soon be noted between the simple fatigue symptoms of neurasthenia and the incipient mental deterioration of general paresis. Of course there can be no diagnostic difficulties when the physical signs of the disease appear. But even without these we may recognize the nature of the malady by making detailed searching inquiries. We may learn that the patient himself is not worried about his difficulties, but that his friends are, who bring him to the physician, because they have seen the patient becoming transformed into an irritable, careless, and otherwise strange being. It is quite different with the neurasthenic, who is himself very much concerned about the reason for his illness and asks a thousand and one questions.

Among the several conditions which have to be differentiated from general paresis must be especially mentioned the mental deterioration of chronic alcoholism and of certain forms of brain syphilis, also non-specific tumors of the frontal lobe.

As against any of the non-luetic diseases we have an excellent means of differentiation in the Wassermann test, but not when brain syphilis is in question. A positive Wassermann indicates that there is either syphilis or general paresis, nothing more. At this point it must be emphasized that while the positive Wassermann does not aid materially in differential diagnosis, for the reasons stated, a *negative* reaction is of considerable assistance in a suspected case of general paresis—it practically excludes it. Wassermann is positive in the blood in from 95 to 100 per cent of cases, which means that the negative reaction does not absolutely exclude the disease, but makes it extremely improbable. Nonne and Hauptmann have changed all this. Their modified method of using a larger quantity of spinal fluid than has hitherto been the custom enables them to get positive Wassermann reactions in every case of general paresis. We therefore have in our hands a certain means of excluding suspected cases of general paresis. For the differentiation between so-called pseudoparesis of syphilis and genuine paresis we must still rely upon clinical signs, a subject into which we cannot enter.

Prognosis.—The final outcome of this disease is death in about three years from its beginning. Recently cases have been reported that have lasted eight and ten years, but these are exceptions. Curious remissions occur in this disease, lasting from a few months to one or two years. Dana thinks he has seen cures; his observations antedated the Wassermann era, and consequently the element of diagnostic uncertainty is present. The tendency is for patients to deteriorate both in mind and body, after each epileptiform or apoplectiform convulsion, until they

become bedridden. Many die from intercurrent disorders or from bedsores; some are carried off by infections of the urinary tract.

Treatment.—Though general paralysis must be considered an incurable disease, it is one that requires treatment. The *prophylaxis* is that of syphilis. The statement "no syphilis, no general paresis," may now be considered proved. Having acquired lues, the best and safest prophylactic against any form of nervous syphilis and parasyphilis is energetic treatment for a long time and a strictly hygienic mode of life, having especial regard for the welfare of the nervous system.

As soon as a diagnosis of general paresis has been made our first endeavor must be to protect the patient's family from financial ruin and the loss of reputation. To this end it will be advisable as early as possible to have a conservator appointed to manage the patient's property and his business affairs. The patient himself must not be permitted to be at large. The best plan is to send him to a public institution or to a closed private sanitarium, where he will be free from all excitement and responsibilities. It is not always possible to convince the relatives that this course is imperative, until it is almost too late to save even a remnant of his worldly belongings. Under an apparently normal exterior it is difficult to believe that the patient lacks the judgment required not to become a prey to all kinds of wild schemes calculated to plunge him into poverty. It is most especially in the early, the so-called incipient stage, that detention is necessary. The quiet and well-regulated life followed in an institution for the insane is conducive to the prevention of the apoplectiform and epileptiform attacks so frequent in the beginning of the disease. At this period, also, outbreaks of violent agitation are common and more easily subdued in a well-equipped asylum. It is quite different during the last stages of the disease; the patient then becomes docile and as manageable as a child, and consequently can be cared for at home without difficulty.

The *direct* treatment of general paresis should include a course of antisyphilitic medication. In spite of the experience that in most cases antiluetic treatment is without the least benefit, I believe each case should be given the benefit of the doubt in the form of a rigid course of antisyphilitic treatment, as one can never be certain how many of the symptoms may be due to a still active syphilitic process. Knowing that nothing else is of any avail as regards curative treatment, there should be no hesitancy in employing remedies which are claimed to cure some cases at least (see Treatment under Syphilitic Diseases of the Brain).

In respect to the use of *arsphenamin* in general paresis opinions still differ. A number of careful observers have seen remarkable improvement from its use, while others, no less competent, have seen no real improvement. Personally, I have no hesitancy in recommending this remedy in general paresis, both intravenously and intraspinally administered, for there is nothing to lose and everything to gain. In the cases coming within

my own observation improvement was noted in the mental symptoms. It is difficult to determine how much of the improvement can be ascribed to treatment, and what amount of it was the result of a spontaneous remission. Most authorities agree that, if arsphenamin is used at all in this disease, the smaller doses should be preferred to one single large dose. The so-called Swift-Ellis treatment finds here a great field of usefulness. Likewise direct intracranial injections of arsphenamin and neo-arsphenamin, and more especially, Ayer's intracistern route have been practiced with results that warrant further trials.

Referring to the exact mode of administering the mercurial and iodid treatment in general paresis, this does not differ essentially from that recommended under the caption of Brain Syphilis. The only difference is in the amounts of the iodid, which should be rather small in this disorder, as patients are more easily affected thereby, there being relative intolerance to the drug in many cases. It is seldom necessary to prescribe more than a dram (4 c.c.) daily of the saturated solution of sodium or potassium iodid. Several courses of the mixed treatment may be repeated, leaving an interval of about a month between each, so as to permit of recuperation from the debilitating effects of the medicines.

Whatever treatment may have been selected—mercury, arsphenamine, or arsphenaminized serum injections, intraspinally—it is absolutely essential that the patient have rest of body and mind and be freed of all responsibilities. In addition the diet must be simple and nutritious, and no alcoholics, coffee, or tea are to be allowed. The daily routine is to be planned so as to include exercise in the open air, carefully graded hydrotherapeutic measures, and general massage.

The symptomatic treatment of the attacks of *excitement* occurring in the paretic upon slight or no provocation is by prolonged immersion of the patient in a warm bath, a method recently adopted by modern psychiatrists as a substitute for bodily restraint. Only those who have witnessed the barbaric old method of strapping a patient to the bed, or have seen the strait-jacket procedure, can realize what a humanitarian remedy is the continuous bath treatment. In exceptional cases it is necessary to administer small doses of hyoscyamin hydrobromid hypodermically and sodium or potassium bromid by mouth. For the occasional attacks of *depression* nothing has proved more effective than the opium treatment, beginning with ½ gr. (0.03 gm.) three times daily, to be gradually increased to 1½ gr. (0.06 to 1.00 gm.). The cases of *hallucinatory excitement* can be advantageously treated with a combination of chloral and morphin. In the *hypochondriacal* cases the patients sometimes refuse to eat, because of a delusion that the stomach has become worm-eaten or is made of glass. In these instances it is necessary to resort to tube feeding and nutrient enemata.

After the patient has returned to his home, as he may during the last

stages of the disease, strict attention must be paid to cleanliness. The bed-clothing must be kept perfectly dry and the body cleansed with soap and water; the bony parts are to be well padded with sterile gauze. By exercising the most scrupulous care and constant vigilance it may be possible to prevent bed-sores, a complication which often carries off the patient. Another dangerous and almost always fatal complication is the development of hypostatic pneumonia, which can be avoided by frequent changing of the patient from side to side. During this stage it will also be necessary to make daily investigation in reference to urinary retention, which is very common among paretics. By percussion of the abdomen from below upward the bladder may be easily outlined. When this organ has become paralyzed the patient must be regularly catheterized and the bladder washed out with a weak solution of boric acid after each catheterization. The mouth must be thoroughly cleaned several times daily; disregard of this precaution favors the development of a regular bacteriological museum in the patient's oral cavity, slowly poisoning its owner. And last, but not least, attention must be paid to the bowels, as the paretic may go without a movement for weeks, unless compelled by force to submit to a flushing or other means of procuring an evacuation.

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CHAPTER XXIII

DISEASES OF THE PONS AND MEDULLA

JULIUS GRINKER

PROGRESSIVE BULBAR PARALYSIS

(*Progressive Glossopharyngolabial Paralysis*)

Definition.—This disease includes those types of bulbar paralysis in which the course is chronic and the condition characterized by a slowly progressive atrophic paralysis of the muscles of the mouth, palate, tongue, and larynx—or, in other words, in which there is involvement of the cranial nerves from the seventh to the twelfth inclusive. Exceptionally the motor nuclei of the fourth, fifth, and sixth nerves are likewise implicated.

Etiology.—The exact cause of this fatal malady is not known. The following factors are mentioned by writers as provocative of the disease: acute cold; overexertion of the oral muscles, as by playing of brass instruments; physical and psychic trauma, with or without syphilis.

Symptoms.—The disease begins insidiously, although there may be a short prodromal stage, during which the patient complains of pain in the neck and of peculiar sensory discomfort in the throat. Gradually the lips, tongue, and larynx become paralyzed. In the majority of cases the first symptoms are noticed in the tongue, which becomes weak in all its movements; the weakness continues to increase until the organ becomes completely immovable and lies on the floor of the mouth as a lifeless mass. Simultaneously with the tongue paresis, speech difficulties make their appearance. At first the letters requiring the coöperation of the tongue, such as *l* and *r*, are imperfectly pronounced; somewhat later, difficulty is also experienced with the enunciation of the labials, namely, *b*, *p*, and *v*. The tongue, toward the last, becomes atrophied, shriveled, and the seat of numerous fibrillary tremors; upon palpation it has the feel of a soft velvety rag. At about the same time mastication and deglutition are impaired—the patient being unable to eat any but semisolid foods. When, in the further course of the disease, the lips become atrophic, speech is still

more interfered with, and blowing, whistling, as well as the act of laughing, are impossible. Like the tongue, the lips also become paretic and permit saliva to constantly escape from the relaxed mouth. The face at this time has a characteristic appearance. The upper portion, which is unaffected, has an expression of intelligence, while the lower half of the face forms a marked contrast with it—appearing stupid and meaningless. This point is so striking and so typical of the disease that it may well serve as a differential diagnostic sign. Because of the palatal paralysis developing in the evolution of this affection the voice becomes nasal in character and resembles more than a little the speech of postdiphtheritic palsy. There is a further resemblance in the phenomenon that fluids regurgitate through the nares, though for a long time semisolid food can be taken with impunity. When the pharynx, perhaps slightly paretic at first, later becomes completely paralyzed, food is likely to drop into the larynx and often causes choking spells. In addition, a progressive paralysis of the vocal cords eventually produces aphonia, so that the patient cannot even emit sounds. A still more serious danger is the development of cardiac and pulmonary disorders from involvement of the vagus. The pulse often becomes irregular, and attacks of syncope are frequent. Owing to the patient's inability to cough and expectorate, an ordinary bronchitis may become converted into a pneumonia, thus terminating the case.

Progressive bulbar paralysis, being a peripheral motor neuron affection, the reflexes in the disease area will be either reduced or abolished. When there is exaggeration of the masseter reflex, or even clonus, we are not dealing with a case of bulbar palsy, but with the beginning of amyotrophic lateral sclerosis. It is important to remember that an electrical examination yields a slight degree of reaction of degeneration, although early in the case the normal electrical reactions may for a long time be obtained.

Differential Diagnosis.—In the majority of cases progressive bulbar paralysis is easily diagnosed. A slowly progressive bilateral paralysis of the muscles of the tongue, pharynx, and larynx, without sensory disorders, occurs in no other condition. However, this syndrome may only be the beginning or the end of progressive muscular atrophy, or of amyotrophic lateral sclerosis, in both of which there will be other symptoms to attract attention to the original malady. Similarly, the bulbar symptom-complex may indicate the termination, or a complication, of diseases like multiple sclerosis, syringomyelia, or tabes.

Pseudobulbar palsy, an upper motor neuron disease, usually the result of two distinct "strokes" of paralysis anywhere above the bulbar nuclei, may give symptoms similar to the peripheral neuron affection. The important points are the history of two separate attacks of hemiplegia, on opposite sides of the body, the presence of the reflexes, and the absence of atrophy and reaction of degeneration.

Asthenic bulbar paralysis—Erb-Goldflam disease—best known as myasthenia gravis, which was classed until recently under the "functional" diseases, may be mistaken for chronic progressive bulbar paralysis. According to Oppenheim, one of the first to describe the "functional" affection, it is characterized by several points of difference. There are no atrophies and there is present normal electrical excitability of muscles. Further, there is often observed the peculiar electrical change called the "myasthenic reaction," that is, after a few contractions the faradic irritability is exhausted and the muscles cease to contract, but have the ability to recuperate after a short period of rest, to give normal contractions again. The tendency to ready fatigability is present not only in the muscles supplied from the medulla, but also in those of the trunk and extremities; likewise in the levator of the eye, which subsequently results in ptosis. Perhaps the distinguishing feature between the fatigue of myasthenia gravis and that of bulbar paralysis is that the former ceases after a short period of rest, while the latter persists.

Prognosis.—Progressive bulbar paralysis is a serious disease, which usually terminates fatally in from six months to several years.

Treatment.—Although the prognosis is exceedingly grave, something may nevertheless be done in the way of treatment. There are physicians who even maintain that a rationally conducted therapy may cause an arrest of the disease. However, though it is not in our power to prolong life indefinitely, we can make the life that exists more agreeable.

Treatment should be begun early, if possible, in order to ward off the implication of vital centers in the medulla.

A patient suffering from chronic progressive bulbar paralysis must be protected from all harmful influences, such as colds, exertion, and trauma, each of which may have had a share in the production of the disease. Perhaps the most important task in the treatment of this disease is to keep up nutrition, as many a patient dies of inanition by starvation, being unable to feed himself properly. Patients should receive a generous, nutritious diet. As they appear to be capable of swallowing semisolid food much more readily than liquids, which are regurgitated through the nares, they should be given puddings, soft-boiled eggs, omelettes, and finely-divided meats in liberal quantities. At a late stage of the disease, when the patient is unable to swallow, it becomes necessary to make use of fluid food, and we must be very careful to prevent choking by not permitting the same to pass into the larynx. Occasionally we are compelled to have recourse to nutritive enemas.

A general *hygienic* treatment is equally important. To stimulate the nervous system to greater activity, treatment by hydrotherapy has been advised. The graduated cold water treatment has also become popular. It appears that moderately cool douches applied to the nape of the neck, along the spine, as well as over the face, seem to cause an increased flow

of blood to the weak muscles, thereby keeping up their nutrition. Vigorous patients may stand warm baths, while old and decrepit individuals must be warned against them.

Electrical Treatment.—Electrical treatment seems to be capable of keeping up the nutrition of the peripheral parts, but I doubt whether it has any effect upon the central nervous structures. Those who believe that central stimulation may do good advise the application of the galvanic current, either to both mastoids, the cervical sympathetic, or one pole on the neck, the other over the pharynx or the face, or the anode may be applied over the neck, the cathode over the angle of the inferior maxilla. For treatment of the peripheral parts, either the galvanic or the faradic current may be used, or galvanism may be alternated with faradism. This may be continued daily for a period of about two months, if the patient's strength permits. Each treatment may last for from ten to fifteen minutes, and the current must be mild, or else more harm than good will result. Galvanism should be applied in the quantity of from ½ to 2ma.; faradism only in sufficient strength to see a fairly good contraction of muscles, if no reaction of degeneration is present. The usual effect on the patient is that he feels invigorated; after each treatment the weak muscles seem to functionate better. Temporarily, at least, the patient has no difficulty in swallowing and phonation sometimes improves. After a systematic course of electrical treatment we occasionally notice a marked general improvement. Erb believes electrical treatment should be given a fair trial in every case.

Massage.—The effects are similar to those obtained from electricity. The muscles of the face and of the larynx, as well as the masseters, must be gently kneaded. The combination of massage and electricity has often produced decided improvement in cases not too far advanced. By appropriate treatment a fatal issue may be long delayed.

Medicinal Treatment.—A number of internal remedies have been tried, but not one of them seem to have exerted any influence upon the progress of the disease. Among those commonly prescribed are nitrate of silver, sodium and potassium iodid, iodid of iron, ergot, arsenic, phosphorus, and quinin sulphate. Gowers recommends hypodermic injections of strychnia nitrate in all atrophic muscular states. Erb, on the other hand, warns against the use of strychnia.

Symptomatic Treatment.—The constant dribbling of saliva may often be reduced to a minimum by the regular administration of atropin sulphate, either hypodermically or by mouth, in doses of 1/100 gr. (0.0006 gm.) three times daily. When cough is troublesome, it may be relieved by means of small doses of opiates or morphin. Mild attacks of dyspnea are treated by anodynes, combined with atropin. When the attacks become severe and life is threatened by suffocation, tracheotomy is our only means of saving the patient.

ACUTE APOPLECTIC BULBAR PARALYSIS

Etiology.—The following are usually mentioned as causes: trauma, arterial disease, cardiac affections, syphilis, and infections from unknown sources.

Pathology.—The most common pathological cause underlying the development of acute bulbar paralysis is thrombosis, followed by softening. Very rarely hemorrhages, also emboli from the vertebral and basilar arteries, may produce the bulbar syndrome. Changes in the medulla, similar to those of encephalitis occurring in the cortex and much like the myelitic processes observed in the cord, are not rarely encountered. Indeed, during the recent epidemics of acute anterior poliomyelitis, combinations of acute bulbar and spinal inflammations have occurred.

Symptoms.—Similar to the chronic form of bulbar paralysis, this disease is characterized by the appearance of bilateral, rarely unilateral, paralysis in the region of the cranial nerves, from the fifth to the twelfth inclusive. The onset is usually acute in the vascular and subacute in the encephalitic cases—differing in this respect from the chronic variety, which is always of slow and insidious appearance. The paralysis involves the muscles of mastication, deglutition, and respiration. Most often the lower extremities are affected in some degree at least. The pathological process being diffuse, the paralysis is neither symmetrical nor limited to the motor nuclei of the medulla, as in the chronic disease. When thrombosis is the cause, paralysis appears rather suddenly—apoplectiform—the same as other vascular attacks in the cerebrum. In the encephalitic variety several days may elapse before the bulbar symptoms develop—the disease setting in, as a rule, with the symptoms of an acute infection, such as headache, chills, and fever. After a few days the bulbar nature of the case becomes evident.

Treatment.—The disease is treated along etiological lines. If syphilis is the causative factor, rigid antisyphilitic treatment will suggest itself as the only course open to the patient. The cases due to a vascular accident, as hemorrhage, thrombosis, or embolism, require the same management as prescribed for the corresponding lesions in the cerebrum. Acute encephalitis of pons-medulla is treated according to the directions given for the cerebral disease, of which internal and external antiphlogistics constitute important items. Oppenheim reports considerable success from the administration of large doses of calomel. Above everything else, constant attention must be paid to maintaining the proper nutrition. Patients suffering from paralysis of deglutition may have to be fed through a tube. Precautions must be taken against the development of aspiration pneumonia, a complication which but too often kills the patient.

COMPRESSION BULBAR PARALYSIS

Pathology.—Bulbar paralysis may be caused by *tumors* of the vicinity or neoplasm of its own substance pressing upon the medulla. Similarly *aneurysm* of the basilar and vertebral arteries may produce compression of medulla, pons, and the nerves issuing from these parts.

Symptoms.—In tumor the symptoms preceding the development of bulbar manifestations are the general signs of brain tumor, such as headache, vertigo, and vomiting. Only when the mass becomes of sufficient size to interfere with the functions of the medulla do bulbar symptoms appear, provided, however, that no hemorrhage has occurred therein; in that case the onset is sudden.

Aneurysm of either the basilar or vertebral arteries compressing the medulla has usually been preceded by a series of symptoms common to other forms of cerebral arteriosclerosis. In this form we are often able to elicit a history of occipital pain and impairment of the head movements. The bulbar syndrome may appear suddenly or come on gradually. There are frequent seizures of anarthria, paralysis of deglutition, dyspnea, accelerated pulse, cardiac irregularity, and occasionally rises in temperature. During the interval between attacks, symptoms may remain to indicate that pathological processes are still at work in the region of the pons-medulla. Among these may be mentioned facial twitchings, paralysis of the facial, trigeminus, acousticus, spinal accessory, and vagus nerves. According to Oppenheim, the alternating and variable character of these paralyses is distinctive of the condition. The paralysis may be of either the spastic or the atrophic type; of the hemiplegic or the paraplegic variety. Oppenheim also speaks of Gerhardt's sign as being of diagnostic import. It consists in the presence of a vascular murmur on the back of the head, which may be heard by the examiner. Another symptom is mentioned as characteristic for aneurysm of the basilar artery, which may be elicited as follows: While the patient is in the recumbent posture, breathing normally, throw his head forward; instantly there is a tendency to the stoppage of respiration in expiration; when the head is thrown backward, normal respiration is again resumed.

Prognosis.—The outlook in compression of the medulla by either tumor or aneurysm is exceedingly grave. It is hardly necessary to state that a tumor in this region is irremovable. As for aneurysm, this, too, eventually terminates fatally. While it is possible for a patient with an aneurysm at the base of the brain to live for months and even years, he is, as John Hunter expressed it, "at the mercy of every rascal who chooses to take his life." After some little excitement, or without any apparent cause, the aneurysm ruptures and instant death is the result. The only

ray of hope is seen in a possible etiology of syphilis, when specific treatment may yield results.

Treatment.—This does not differ from that of tumor of the brain situated elsewhere, except that surgery is out of consideration in pontine tumor. However, should symptoms result from large or small cerebellopontile angle tumors, surgery is not only to be tried as a last resort, but should be instituted as soon as a diagnosis has been made.

In the aneurysmal cases the treatment is identical with that of cerebral arteriosclerosis, acute bulbar paralysis, and cerebral thrombosis. I am of the opinion that moderate doses of sodium iodid have a beneficial palliative effect upon aneurysm. Great triumphs may occasionally be achieved in the syphilitic cases. Of course, there can be no limit to the amount of antisyphilitic medication which such a patient should receive. Its administration means the saving of life in a case without any other hope of recovery.

PSEUDOBULBAR PARALYSIS AND CEREBROBULBAR GLOSSOPHARYNGOLABIAL PARALYSIS

Introduction.—In order to understand this condition it is well to recall a few anatomicophysiological data. Following the neuron theory, each motor neuron consists of at least two kinds—an upper and a lower neuron. The nuclei contained in the medulla constitute the beginning of the lower neuron; their upper representation being situated just above and originating in the cortical cells. Similar to upper motor neuron lesions in the skeletal muscles, there is an upper motor neuron affection of the medulla, capable of producing paralysis of its functions. This disease we shall now discuss—its peripheral counterpart, progressive bulbar paralysis, having been already considered.

By pseudobulbar paralysis we mean that the central or upper representation of the medulla has been interfered with, the necessary messages no longer reach the peripheral structures, and the result is a paralysis not unlike that of the genuine bulbar variety. As long as stimuli from above can pass down, even though it be through one limb of the arc, there is no appreciable derangement of function. But no sooner has anything occurred to completely isolate the medulla from its higher centers, as, for instance, a second "stroke," than the bulbar paralysis becomes complete.

Etiology.—Everything which stands in a causative relation to the production of hemorrhage, thrombosis, and embolism may be considered a cause of this disease. The chief factors are: syphilis, arteriosclerosis, heart disease; insular sclerosis and multiple cysts may rarely produce the syndrome of pseudobulbar palsy.

Infantile pseudobulbar palsy yields identical symptoms. Oppenheim

has described this condition in children in connection with cerebral diplegia. The infantile variety is due to an arrest of development or malformation of the lower parts of the central convolutions.

Pathology.—The pathological conditions underlying the production of pseudobulbar palsy are usually vascular changes causing either hemorrhage, thrombosis, or embolism. Further, it matters little which portion of the upper motor neuron has become implicated; the essential requisite is that the lesion must have occurred before the central fibers have arborized around the nuclei of the medulla. It is also necessary that both sides shall have become affected, either simultaneously or in succession. Oppenheim states that in many cases additional foci of inflammation or softening are found in the pons.

Symptoms.—In the majority of cases there is a history of a first attack of hemiplegia with perhaps some slight disturbance of phonation or deglutition. Soon a second apoplectiform seizure takes place and a complete or incomplete case of bulbar palsy becomes established. The symptoms are like those of the fully developed progressive bulbar paralysis. A patient so affected presents an expressionless, even stupid face, particularly in its lower half; an open mouth, from which saliva dribbles more or less constantly; paresis of the muscles of the cheeks, lips, tongue, palate, mastication, and of the vocal cords. In addition there are nasal intonation to the voice, dysarthria with or without aphonia, dysphagia, or even complete inability to swallow; toward the last respiratory difficulties with attacks of dyspnea may become frequent. There are a number of symptoms characteristic of the pseudobulbar form, thus distinguishing it from the chronic progressive variety. Among these must be emphasized the absence of atrophy in the paretic muscles and the preservation of reflexes and of the normal electrical reactions. Added to these there may be unilateral or bilateral hemiplegia, occasional involvement of the optic nerves—mild neuritis or optic atrophy—occasioned by the numerous arteriosclerotic foci scattered throughout the visual tracts. In a number of cases bladder and rectal disturbances have been noted. Czylharz-Marburg's researches of the sphincters, having a bilateral representation in the ceentral ganglia, may throw some light on this symptom.

It is interesting to observe that paralysis of the muscles is not complete; movements which can no more be executed voluntarily may still be set in action by emotional causes. Speech may be impossible, but involuntary emotional responses may still be preserved. Another remarkable symptom is the modification in the acts of mimicry—the patient may have explosive outbreaks of spells of crying and laughter.

Mental symptoms are almost always present in pseudobulbar paralysis. There are usually marked impairment of memory, apathy, confusion, and quite often there is a degree of dementia present.

Differential Diagnosis.—This condition must be differentiated from genuine bulbar paralysis, acute bulbar paralysis, and the bulbar form of myasthenia gravis. The differential diagnosis has been sufficiently discussed in the previous paragraphs, and I do not think there will be any difficulty when one has mastered the few essential points.

Treatment.—Antisyphilitic medication may be given a trial even in cases that are frankly non-syphilitic in character. Even in these cases some improvement has been seen from the administration of the iodids in moderate doses, given over extended periods of time.

The symptomatic treatment is similar to that of the other varieties of bulbar paralysis.

MYASTHENIA GRAVIS

(*Asthenic Bulbar Paralysis*)

Introduction.—This is a disease in which excessive *exhaustion* is the prominent symptom. After a period of rest partial recovery of power often occurs, but the affected muscles are, as a rule, incapable of doing sustained work.

Etiology.—The sexes are about equally divided, and the disease appears during the first half of life. The exact etiology is still a matter of speculation.

Pathology.—Nothing definite is known even with regard to the etiological pathology of this interesting condition. With reference to the central nervous system, nothing notable has been found beyond some indefinite and inconstant changes in the cranial nerve nuclei. The view is now generally held that the essential pathology is in the muscles themselves. Weigert and others have found an exudation of lymphoid cells in the muscle substance, and this is consequently thought to be the cause of the disease. Another frequent finding is an enlarged thymus gland, which may be the seat of lymphosarcoma. No connection has been established between thymus involvement and the exudation of lymphoid cells into muscles. Most writers favor the view that the condition is caused by toxins, the origin and composition of which are still to be discovered.

Symptoms.—Weakness in the musculature is the leading complaint. As not all parts are equally affected, the symptoms will vary with the number and function of muscles involved. Variations in the intensity of symptoms are quite common, and alternating exacerbations and remissions are almost the rule. Among the most serious forms of this disease are the ocular and bulbar varieties. Of the *eye muscles,* the levator is most prone to become affected; the resulting symptom then is ptosis. The patient is unable to keep his eyes open for more than a few seconds;

there is a tendency for the lids to droop and for the eyes to require frequent rests. After a short interval the patient again uses his eyes, but fatigue soon returns. In order to see at all the patient is compelled to throw his head back and even to hold up the lids with his fingers. The compensatory action of the occipitofrontalis, seen in the wrinkling of the brow—a usual feature of ptosis from other causes—is generally absent because of the rapid exhaustibility of this muscle. Transient ocular palsies of various other kinds are also observed; likewise nystagmus.

Bulbar symptoms appear chiefly in connection with the muscles of the mouth, tongue, and palate. Weakness of the orbicularis oris makes it difficult for the patient to blow or whistle, and even speech may become affected. During the states of exhaustion the tongue cannot be protruded or forcibly moved from side to side. The paralyzed soft palate no longer shuts off the nasal from the oral cavity, and a nasal voice is produced in consequence. There may also be difficulty in swallowing, with regurgitation of fluids through the nose. All the muscles seem to tire after the slightest exertion; even the masseters become exhausted during a meal, preventing its completion. The facial muscles may likewise suffer, permitting the appearance of a drooping lip. Gowers mentions as characteristic for this condition the so-called "nasal smile," in which the movement at the corners of the mouth is deficient, the furrow of the smile being sometimes entirely above the upper lip.

The limbs are frequently affected. The patient then becomes easily fatigued; walking is tiresome and manual labor impossible. Any occupation requiring the use of the hands is out of the question. The neck muscles may suffer and allow the head to fall forward on the chest. When the muscles of respiration participate, there may occur attacks of dyspnea.

An objective symptom of great importance is the so-called myasthenic reaction. This consists in a great exhaustibility of the voluntary muscles by the faradic current. When the muscles are stimulated, at first the contractions may be fairly good; after a short time, perhaps within a few minutes, the muscles become less and less responsive, until the contractions cease altogether. After resting a little the muscles again respond to electrical stimulation. It is noteworthy that, though an electrical response may not be obtained, the muscles still obey the will. The myasthenic reaction, when present, is a very valuable diagnostic sign. It varies in completeness, however, from time to time, and is not found in all muscles.

There is nothing pathognomonic about the reflexes; they may be present, absent, or reduced. When present, the knee reflexes can be easily exhausted after a few tappings. There is seldom wasting of individual muscles, though the patient may appear generally emaciated. Of sen-

sory symptoms paresthesia may be complained of, but objective sensory disturbances cannot be elicited.

Differential Diagnosis.—The cases must be discussed as ocular, bulbar, and spinal types, according to the parts in which the first symptoms appear. When *eye* symptoms are prominent, conditions in which ptosis and partial ophthalmoplegia are symptoms must be differentiated. Tabes with ocular palsies may occasionally be mistaken for myasthenia of this type. A search for other symptoms of the disease, such as Argyll-Robertson pupil, lancinating pains, the loss of knee reflexes, and the presence of ataxia, should decide the diagnosis. Migraine with transient ocular palsies may be differentiated by the palsy always having a definite relation to the head pain. Ptosis may be a symptom of brain tumor, syphilis, or hysteria. In the latter disease the ptosis is spasmodic, and not paralytic, as in myasthenia. For tumor and syphilis there will be a multitude of other signs to clear up the differential diagnosis.

From the *bulbar* variety progressive bulbar paralysis and postdiphtheritic palsy must occasionally be differentiated. In the chronic organic bulbar disease the course is progressive, there is distinct wasting of muscles, there is no remission in symptoms, and the myasthenic electrical reaction is absent. Postdiphtheritic palsy should be differentiated by the history and course of the disease, as well as by the electrical examination.

The *spinal* type of myasthenia has frequently been mistaken for neurasthenia. By attention to details, and the golden rule never to diagnose the latter disease until every other condition has been excluded, mistakes can be avoided. Under certain circumstances progressive muscular dystrophy can be mistaken for myasthenia gravis. In both the patient tires easily and is generally weak. Of course, the localized atrophies found in the dystrophic condition would be of great assistance if always present. Early in its course, however, atrophies may not have declared themselves as yet. In that case the careful electric examination of muscles will usually settle the diagnosis.

Prognosis.—The prospects for recovery are not favorable in the majority of cases. Remissions and intermissions of long duration are the rule. In a small number of cases symptoms have permanently disappeared. Unfortunately the tendency even in those who have had remissions is toward greater exhaustibility. The patient usually dies during an attack of respiratory or cardiac failure, or succumbs during a choking spell while eating.

Treatment.—In the treatment of a case of myasthenia gravis great patience is required. The ordinary method of applying electricity by means of irritating galvanic and faradic currents, as advised in chronic progressive bulbar paralysis, is contra-indicated in myasthenic bulbar palsy. Such measures endanger the patient's life. No objection can be

had to the application of central galvanization in very small quantities of current, which by some is claimed to be followed by great benefit.

The most important point in the treatment is the husbanding of the patient's strength, avoiding all muscular exertion. In a severe attack he must not leave the bed, nor must he be permitted to speak. As such patients have difficulty in masticating their food, and in swallowing, they do not eat sufficiently. It will be our endeavor, then, to give them concentrated, nitrogenous, and even partly digested foods, so as to keep up their nutrition to the highest point. During meals frequent pauses should be interposed, in order to rest the exhausted muscles; but patients must be constantly encouraged to conclude their meals.

The medicinal treatment consists of tonics, of which strychnia is the most popular one. There are those, however, who condemn this remedy. Oppenheim advises the use of hypophyseal extract and ovarian tablets; also the double salt of spermin sodium chlorid, hypodermically, in doses of 1 c.c. of a 2 per cent solution, daily, or every other day.

OPHTHALMOPLEGIA

Introduction.—Paralysis of ocular muscles is encountered in a number of conditions and is a symptom in many diseases. The eye syndrome may assume such significance that it almost becomes an independent symptom-complex. For the sake of brevity we shall only discuss the acute and chronic varieties.

Acute Ophthalmoplegia

This variety is probably always caused by either intoxication or infection. The cases of hemorrhagic poliencephalitis superior of Wernicke seem to be part of this group. In some instances it is difficult to classify the cases in reference to whether they are toxic or encephalitic in character. This is particularly true when they result from the ingestion of poisonous meats, fish, sausages, or are caused by carbon dioxid poisoning. Acute ophthalmoplegia may also be caused by hemorrhage into the ventricles, exciting an inflammation in the nuclear region. Traumata of all kinds, especially the late forms of apoplexy, are etiologic factors in their production. The inflammatory forms of acute ophthalmoplegia are probably caused by acute infectious diseases, such as influenza. Among the several other causes may be mentioned syphilis, tuberculosis, alcoholic intoxication, ptomains from decayed fish and meat. Lead and other inorganic poisons may likewise have a selective effect upon the ocular nuclei.

Symptoms.—When the result of hemorrhage, there will probably be a sudden onset, with vomiting and convulsions, followed by the appearance of paralysis in one or more ocular muscles. In cases due to acute hemorrhagic poliencephalitis, prodromal signs, such as general malaise, headache, vertigo, and vomiting, may precede the development of the disease proper. The temperature is variable; it may be high or low, or remain within normal limits. Shortly after the development of the first symptoms, paralysis of the ocular muscles appears; the muscles usually escaping are the levator palpebræ superioris and the sphincter of the iris. Headache and vertigo may continue and may even become worse. If the case proceeds toward a fatal termination, stupor and coma are added. Acute ophthalmoplegia is usually bilateral and may occur in association with poliomyelitis or with the paralysis of face, tongue, and palate, due to the nuclear involvement of acute bulbar palsy.

Differential Diagnosis.—From neuritis of the ocular nerves this affection is distinguished by the presence of convulsions, muscular twitchings, headache, stupor, or coma. It must be remembered that this syndrome may actually be due to neuritis and that the diagnosis between the two may be impossible; the existence of neuritis in another part of the body makes this diagnosis the more plausible. A differentiation may have to be made between the acute variety of ophthalmoplegia and the ocular form of myasthenia gravis. The difficulty will be overcome when one thinks of the myasthenic reaction, the fatigue of muscles and nerves, capable of being temporarily, at least, removed by prolonged rest.

Prognosis.—The disease is often fatal; the most favorable cases being those following infectious diseases and the neuritic types. In those who recover paralysis may remain permanent.

Treatment.—This is identical with that given previously for the treatment of acute hemorrhagic encephalitis. Ice to the head and derivative remedies to the lower extremities, including the administration of calomel and other cathartics, should not be omitted. To allay the extreme restlessness, bromids and small doses of morphin are indicated. In debilitated cases stimulants should not be withheld. Lumbar puncture is of distinct benefit when there is increased intracranial pressure. During convalescence invigorating tonics are indicated to restore the paralyzed muscles.

Chronic Ophthalmoplegia

Etiology.—This variety may constitute the end result of a case of acute ophthalmoplegia, in which degenerative changes have taken place. Further, chronic degeneration of the nuclei may be due to syphilis, diabetes, diphtheria, or it may be an associated symptom of tabes, paresis, multiple sclerosis, progressive muscular atrophy, or chronic bulbar palsy.

Chronic ophthalmoplegia may appear as a congenital affection or as an hereditary disease.

Pathology.—The lesion is a chronic degenerative or inflammatory process found in the floor of the third ventricle and the aqueduct of Sylvius, which causes atrophy of the ganglion cells of the nuclei there situated. The pathological process is similar to that occurring in progressive spinal muscular atrophy and chronic poliomyelitis.

Symptoms.—The disease is characterized by a gradual and progressive development of paralysis involving one or more ocular muscles. One of the earliest symptoms is diplopia, which may be transient at first. Somewhat later other muscles become affected, often irregularly and without reference to function. Ptosis may be absent or incomplete. The paralysis may cease to progress and may remain more or less stationary. The more probable course is for the pathological process to implicate all the eye muscles. The disease may be unilateral, or it may affect both eyes. In some cases only the external muscles are involved; in others only the internal muscles.

Differential Diagnosis.—This can only be made from the etiology and from coexisting symptoms. For the nuclear forms no definite diagnostic criteria can be given, excepting, perhaps, the common experience that the inner eye muscles are usually spared and that ptosis is rarely present or well defined. Symptoms are almost always bilateral. Not infrequently the chronic nuclear disease follows other cerebral or spinal diseases, pointing to degenerative conditions of cortex or cord, as in general paresis, tabes, bulbar myelitis, or poliomyelitis.

Prognosis.—The chronic cases often have a protracted course and may last for years. They may, however, become completely arrested in their progress.

Treatment.—This will largely depend upon the cause. If alcohol is an etiologic factor, it must be withdrawn and abstinence substituted therefor. In addition all causes must be avoided having a tendency to produce congestion of the brain. Syphilis being a common antecedent in these cases, it is well to institute a rigid course of antispecific treatment, consisting of both mercury and iodids, as described under Syphilis of the Brain. In the presence of a local cause, such as tumor, the outlook is unfavorable.

If chronic ophthalmoplegia is part of a degenerative nervous disease, such as tabes, general paresis, or bulbar paralysis, the prospects are still worse. In all cases iodids in good-sized doses may be tried, as there is nothing better at our disposal, and we are never certain that even in an apparently non-specific lesion there is not some specific etiology. Treatment by electricity has its advocates; likewise hydrotherapy. Any of these measures may benefit the patient's general health, including the nervous lesion.

It is my opinion that a systematic course of strychnia in gradually increasing doses, beginning with 1/30 gr., and increased up to 1/20 gr., three times daily, should be tried for several months.

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CHAPTER XXIV

DISEASES OF THE CEREBELLUM

JULIUS GRINKER

Various diseases of the cerebellum have already received brief mention in connection with corresponding cerebral diseases. Hemorrhage, softening, inflammation, abscess, and tumor of the cerebellum require no separate description in this place. Hereditary cerebellar ataxia and atrophy and sclerosis of the cerebellum must still be discussed.

ATROPHY AND SCLEROSIS OF THE CEREBELLUM

Congenital smallness of the cerebellum may be due to absence of lobules, or of a whole hemisphere; the entire cerebellum has been found in a rudimentary state.

There are also *acquired* forms, which result in shriveling, induration, and atrophy of the whole cerebellum or of some of its parts. Stated differently, there are both developmental and focal diseases of the cerebellum, which may occur in fetal and in extra-uterine life. Some of the pathological changes are entirely vascular—hemorrhage, softening, inflammation; others are meningeal in character.

In addition there is a *cerebellar* type of *infantile palsy,* with lesions in the cerebellum, instead of in the brain. In some of the cases the disease comes on acutely as a severe brain affection, but leaves behind a permanent paralysis. The children are unable to walk years after the onset of the disease, and can be observed crawling on all fours. The disordered functions are probably of the cerebellar coördinating mechanism. An acquired case of this kind has been studied by Oppenheim and Arndt. They found sclerosis and atrophy of the corpus dentatum on postmortem examination.

The phenomena observed in different instances of cerebellar atrophy were not always the same. In the majority of the cases one or more of the following symptoms were observed: defective mental development, cerebellar gait, vertigo, dysarthria, scanning speech, intention tremor, and ataxia of speech muscles. Several observers have mentioned the

existence of exaggerated reflexes. Epileptic attacks, paralysis of ocular muscles, as well as abnormal position of eye muscles have been attributed to disease of the cerebellum. According to Oppenheim, the cerebellar ataxia, vertigo, and perhaps also speech disturbances might have been caused by the cerebellar disease. All the other symptoms were probably produced by hydrocephalus or cerebral involvement. Mental signs, found in several instances, may easily be explained by the hydrocephalus which was also present.

Atrophy of the cerebellum has been detected in several cases which presented symptoms similar to Friedreich's disease. Nonne, for instance, described a family disease, in which he found postmortem an abnormal smallness of the entire central nervous system. The disease had developed in three brothers either at puberty or later, and ran a chronic course in all. The symptoms were loud and explosive speech, nystagmus, imbecility, paralysis of ocular muscles, simple optic atrophy, incoördination, and increased reflexes. It is not likely that all of these symptoms were due to abnormal smallness of the cerebellum.

Treatment.—Vascular accidents of the cerebellum require treatment similar to that of the cerebrum, already described under another heading. Likewise the treatment of cerebellar inflammations differs in no essential from that of the cerebral forms. It goes without saying that developmental errors are not amenable to treatment.

HEREDITARY CEREBELLAR ATAXIA

(*Hérédo-ataxie Cérébélleuse*)

Introduction.—Marie first described this disease under the name "hérédo-ataxie cérébélleuse" and pointed out the differences between it and the hitherto well-known disease, Friedreich's ataxia.

Etiology.—There is usually a neurotic family history. Among other things, alcoholism, tuberculosis, and consanguinity in the parents, as well as syphilis, have been made responsible for this affection. Infectious diseases and traumatism are said to play an important rôle in its causation. Members of the same family frequently develop the disease at about the same age; females are more often affected than males.

Pathology.—The cerebellum is smaller than normal, owing to an arrest of development. The medulla and spinal cord have also been found in an atrophic condition. In Marie's first case there was, besides, sclerosis of Goll's tracts, Gower's columns, and of the direct cerebellar tracts. The middle cerebellar peduncle was markedly reduced in size. In one or two instances the gray matter of the cerebellum was seen to be patho-

logically altered. Rarely is the cerebellum affected without other portions of the nervous system.

Symptoms.—Incoördination is the characteristic and striking symptom. In the majority of cases the lower extremities are affected before the upper. There are seen the reeling gait, with asynergy, asthenia, ocular disorders, and exaggerated reflexes; in fact, the usual symptoms of cerebellar disease are observed in this affection. Its onset is rather insidious. For some time previous to the development of equilibratory disturbances the patient may have complained of neurasthenoid symptoms. Soon headache, back pains and a general feeling of lassitude make their appearance. In rapid succession are then noticed typical cerebellar ataxia and peculiar speech disturbances. The patient's voice is so changed that speech is either explosive, monotonous, guttural or unintelligible. As the disease progresses, the upper extremities also become incoördinate. The arms and hands are uncertain in all movements, and tremor is developed upon activity; eventually writing and sewing become impossible. Not only in the physical but also in the mental sphere are disturbances present. Memory is considerably impaired, the patient becomes apathetic, irritable, and indifferent to his environment.

Prognosis.—The tendency is for the disease to become progressively worse, though long remissions have been observed. During the last stages the patient remains helpless in bed and usually dies of some intercurrent complication.

Differential Diagnosis.—The history and onset, as well as the gradual development of symptoms, and the hereditary and family characteristics enable the differentiation to be made from tumor, hemorrhage, or abscess of the cerebellum. Some difficulty may be experienced in distinguishing this disease from Friedreich's ataxia. The most important differential sign is in the deep reflexes: their presence in Marie's disease and their absence in Friedreich's ataxia.

Treatment.—From the therapeutic viewpoint an apology is due the reader; there is no treatment. Following the vague assumption that some cases may be due to a syphilitic ancestry, specific treatment may be tried in the usual manner.

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CHAPTER XXV

NEUROSES

LEWELLYS F. BARKER, CHARLES M. BYRNES, TRIGANT BURROW AND SMITH ELY JELLIFFE

GENERAL TREATMENT OF NEURASTHENIC AND PSYCHASTHENIC STATES, INCLUDING THE PHOBIAS

LEWELLYS F. BARKER AND CHARLES M. BYRNES

Introductory.—The functional neuroses are maladies in which there are disorders of personal adjustment to the environment. They are, in fact, minor psychoses. In the present section we shall consider the treatment of the so-called neurasthenic and psychasthenic states (exclusive of the hysterical states and the major psychoses).

In the neurasthenic, and especially in the psychasthenic states, the symptomatology is predominantly mental. The states are spoken of as "nervous affections" or "neuroses," a terminology that is justifiable since the patients and the patients' friends usually have a horror of mental disease. Physicians, however, should never permit this fear on the part of the laity to distort their own view of such cases; medical men should recognize that the symptoms presented by these patients are largely abnormal sensations, feelings, and psychic reactions. Neurasthenic and psychasthenic states belong in the broad borderland between mental health and outspoken mental disease (insanity). We must regard them as mild forms of mental disorder, for one sees, in practice, every transition from such states to the more serious mental disorders that we designate as psychoses. But mental disorders—mild and severe—are to be regarded as cerebral diseases; a disturbed mentality means abnormality of cerebral function. There may be no such thing as a *purely* psychic disorder, for in scientific medicine, most men work on the assumption that psychic manifestations and cerebral processes go parallel with one another. Neurasthenic and psychasthenic states are often spoken of as "functional" nervous diseases, sharply separable from the so-called "organic" nervous diseases. This is a purely arbitrary division. In both sets of diseases

there may be material changes in the nerve cells. The changes in the cells, if such exist, in the so-called functional nervous disorders are so slight—possibly molecular, or ionic—that they are not demonstrable by the means at present at our disposal. Too much stress should not, however, be laid upon this view; indeed, as Meyer especially has emphasized, there is some advantage to be gained in studying the mental facts as such, without considering the possibility of "lesions" or "diseases" underlying them. Different workers may well approach the problems of abnormal mentality in different ways and, in the end, all contribute to their solution.

Another point to be kept ever in mind is this: the neurasthenic and psychasthenic states may be due to cerebral conditions that are in part due to some primary organic disease elsewhere in the body. Every physician knows how frequently a neurasthenic or a psychasthenic state presents itself at the onset of some organic disease in some other part of the body; the primary organic disease may involve, perhaps, an organ far removed from the nervous system, or from the parts in which symptoms are first complained of. Examples of such symptomatic neurasthenic or psychasthenic states may be met with at the beginning of a pulmonary tuberculosis, in association with a chronic inflammation of the paranasal sinuses, in the larvate forms of exophthalmic goiter, in chronic arthritis of the spine, in abnormalities of the eye (refraction errors; muscular insufficiencies), in the early stages of brain tumor, in tabes and general paresis, in cerebral lues, in pelvic inflammatory disease, in anemia, in visceroptosis, at the onset of some of the psychoses (dementia præcox; manic depressive insanity), in various intoxications (abnormalities of internal secretion, gout, diabetes, chronic constipation, drug habits, alcoholism, tabagism), in atherosclerosis, etc. For this reason it is desirable that every patient complaining of neurasthenic or psychasthenic symptoms should be subjected to a most careful general clinical study, including a thorough examination of all the organs of the body, as well as of those of the nervous system proper. A neurologist who confined his examinations to the testing of the nervous and mental functions only would sometimes overlook the existence of one of the diseases mentioned. The importance of a thorough training in inner medicine for all neurologists, and of a good training in neurology for all who work in inner medicine, is thus emphasized. He who undertakes the treatment of neurotic patients should be skilled in all the modern refinements of diagnosis and should exhaust them in the study of his case, or have some skilled physician, or group, do so for him, before beginning his therapy.

In the *neurasthenic states,* the most constant symptom is fatigability, often accompanied by headache, or a sense of pressure in the head, pain in the back, and insomnia. The patients are often depressed mentally, and tend to focus their attention upon slight disturbances in the digestive apparatus, in the circulatory apparatus, or in the genito-urinary apparatus

They make up the large contingent known as false gastropaths, false enteropaths, false cardiopaths, etc.

In the *psychasthenic states,* the patients suffer from sensations of incompleteness, from disturbance of the feelings of reality, and from other symptoms referable to "lowering of the psychologic tension." Among the characteristic phenomena met with in psychasthenia, so carefully studied by P. Janet, may be included (1) obsessions, (2) pseudohallucinations, (3) abnormal impulsions, (4) mental manias, (5) ruminations, (6) tics, (7) forced agitations, (8) phobias, (9) deliria of contact, (10) anxiety conditions, (11) sense of strangeness and unreality, and (12) phenomena of depersonalization.

Phobias are met with clinically in immense variety. The classification of phobias proposed by Janet is very good. He divides these pathological fears into four great groups: (1) the algias, and bodily fears; (2) the fears of objects (*délire du contact*); (3) the fears of situations (agoraphobia), and (4) the fears of ideas.

Among the *phobias of the body* are included: (*a*) the algias in different parts of the body (chest, skin, head, feet, hands, limbs, genitals, bladder, anus, etc.); and (*b*) the *phobias of bodily function* (movements, writing, walking, eating, swallowing, digesting, defecating, breathing, speaking, smelling, hearing, seeing, etc.).

Among the *phobias of objects* are included the fears of dangerous objects, of dirt, of people, of animals, of professional instruments, etc.

Among the *fears of situation* are included: (*a*) fears of physical situations (agoraphobia, altrophobia, claustrophobia); and (*b*) fears of *social situations* (fear of blushing, fear of looking peculiar or of acting strangely, fear of servants, fear of marriage, etc.).

Among the *fears of ideas* may be included: (*a*) fears of religious ideas; (*b*) fears of moral ideas; (*c*) fear of death; (*d*) fear of insanity; (*e*) fear of disease, etc.

With some patients, instead of these systematized, emotional, compulsory agitations, the fear takes a diffuse form, either that of *physical anxiety* (digestive, circulatory, or respiratory), or of *general mental anxiety.*

When reading in the literature of the subject, some attention must be paid to the different ways in which terms are used by different neurologists. Thus, some apply the term *neurosis* or *psychoneurosis* to any one of the so-called functional nervous disorders. Aschaffenburg and Binswanger, in Germany, and Janet, Déjerine, and Bouveret, in France, emphasize especially the psychic side of these cases. But while Aschaffenburg would include hysteria, psychasthenia, and neurasthenia all under the general term, "psychasthenic states," Janet sharply distinguishes hysteria from psychasthenia. In America, Beard emphasized the independence of neurasthenia as a disease entity, while the majority of

writers (especially Dana; Bartholow and Browning) have stressed its symptomatic nature.

Freud, of Vienna, excludes the symptomatic neurotic states like those occurring in Basedow's disease, in tetany, and in chorea, from the neuroses proper. He divides the neuroses, thus restricted, into two great groups: (1) the "actual neuroses"; and (2) the "psychoneuroses." They are all, in his opinion, of sexual origin. The "actual neuroses" include (*a*) "neurasthenia proper," and (*b*) the "anxiety neuroses"; the psychoneuroses include (*a*) hysteria, and (*b*) the so-called "compulsory neuroses." Freud's classification is based upon his view that in the "actual neuroses" some abnormal sexual activity is going on at the time, whereas the psychoneuroses, he thinks, are due, not to abnormal sexuality at the time the symptoms occur, but to abnormal sexuality in early childhood. Freud further states that the symptoms in the "actual neuroses" appear to be toxic in nature, while in the "psychoneuroses" they are "psychogenic" in origin, depending upon the activity of unconscious (suppressed) idea-complexes of sexual-erotic content arising from the sexual needs of unsatisfied persons, the symptoms representing a sort of "substitute satisfaction." Freud admits also the existence of *mixed cases* in which a compulsory neurosis is combined with neurasthenia or an anxiety neurosis with hysteria; in these mixed cases he assumes a combined etiology. Freud believes that, in hysteria, the symptoms are due to the permanent action of psychic complexes, the emotional accompaniments of which have become separated from the patient's consciousness and have led to abnormal innervations of the body (phenomena of "conversion"). In the compulsory neuroses (psychasthenic states), on the other hand, though the emotion has become separated from its original sexual idea, it is not "converted" into abnormal bodily innervation, but attaches itself, he believes, to some other idea, in itself indifferent, thus giving rise to an obsession or a phobia (phenomena of "substitution"). According to this view, both hysteria and the compulsory neuroses are instances of unsuccessful efforts at "defense" (*Abwehr*), of unlucky attempts to drive painful ideas and emotions from consciousness (*Verdrängung*).

A strong reaction against the Freudian teachings has set in, and though all admit the great importance of sexual instinct in connection with many of the pyschoneuroses, the majority of neurologists incline to the view that Freud and his stricter adherents have given overemphasis to sex, to the neglect of other fundamental instincts.

In recent years much attention has been paid to the teachings of Adler who has discussed especially the so-called "inferiority complex" and the "neurotic constitution." This author urges attention to the absence of a sense of security, to the tendency to maximize the ego, and to the so-called masculine protest if one desires to understand psychoneurotics.

Prophylaxis

Though the prevention of disease is the physician's highest aim, most preventive measures require, to be effective, not only an enlightened medical opinion, but also an educated and coöperative public sentiment. This is especially true in regard to abnormal psychic states. Before much can be expected from prophylactic measures, the physician must learn how to detect the earliest manifestation of neurotic conditions, and the laity should have, at least, some understanding of the normal processes of psychical development and of the conditions that tend to abnormality.

Long converted to the doctrines of physical hygiene, medical men have been slow to awaken to the importance of mental hygiene, perhaps because this was formerly thought to belong in the domain of the clergyman and of the schoolmaster rather than in that of the physician.

The more we study the psychoneuroses, the more we become convinced of the importance of the affective life—the life of the emotions and sentiments—for their pathogenesis. Emotions are an essential part of life; they cannot be avoided; indeed human life without them would be undesirable, even if it were possible. The mischief lies most often in a lack of harmony and of unity in the personality as a whole, made up as it is of cognitive, affective, and conative elements. Anything that we can do (1) through *heredity* to develop human nervous systems capable of a full and harmonious development of the intellect, the emotions and the will, and (2) through *environment* to bring to bear upon the nervous systems the influences that will be helpful, preventing, as far as possible, the action of influences that we know can be harmful, will be a contribution toward the prophylaxis of the psychoneuroses.

Experience teaches that those persons that become absorbed in the attempt to work toward the realization of an ideal—practical, religious or philosophic—are far less prone to nervous breakdown than those that have no definite aim in life, no unitary direction to their thoughts, feelings and activities, nothing, in other words, sufficiently adequate to integrate the divers constituents of a personality.

Race.—Heredity undoubtedly furnishes the foundation for many of the neuroses. Thus, it is well known that certain races show marked susceptibility. The Hebrews, Slavs, Poles, Russians, and Americans are particularly liable. This innate tendency reveals itself when these races are exposed to hardship and strain. It is especially noticeable among members of the immigrant class who make their homes in the crowded districts of our larger cities. Many of them arrive when quite young, almost without money, and are forced to accept any employment that will insure a bare livelihood. Not a few of them have broken home ties on account of intolerable social and domestic conditions that have already

left telling marks upon their unstable constitutions. Conditions in the New World are not what were expected. In time, the faulty social, economic, and hygienic surroundings overcome the small physical and mental reserve, and "neurasthenia" is established. It is now too late for prophylaxis and treatment is difficult. If the existence of conditions like these were more fully recognized and appreciated, and a proper study made of the surroundings of such people, much could be done by society to protect from too great environmental strain those that have inherited bad nervous systems; as it is, despite the beginnings made by workers for social betterment, the victims too often fail to attract attention until forced by their ailments or incapacity to apply for aid to a neurological dispensary or a Social Service Committee.

Eugenics.—But it is not only in the humbler walks of life that heredity is important as an etiological factor. No race, class, or condition is immune from abnormal psychic states; and if we are to apply what we know regarding hereditary transmission of a neuropathic tendency, it is clear that prophylaxis should really begin before birth. The thoughtful physician will deprecate marriage or, at any rate, parenthood, among those with decided hereditary neuropathic and psychopathic tendencies. Bouveret and Godlewski have expressed strong opinions in discussing this question of eugenics. The former states that marriage should be prohibited in the hereditary type of neurasthenia. It may, he thinks, be permitted in the acquired form, however, provided the patient has improved and there is no nervousness in the family into which he or she marries. Godlewski thinks that marriage between two persons, both of whom are neurotic, should be regarded with disfavor. Should only one be neurotic, the children are not so likely to suffer.

In some states in America, laws have already been passed, providing for the denial of the privilege of parenthood to the "manifestly unfit" (habitual criminals; epileptics; the feeble-minded; the insane; chronic alcoholics). In Sweden, especially, an attempt is being made to provide for parents of good stock among the peasant classes, with the hope of improving the race.

It is highly desirable that parents having good heredity should have at least four or five children and that parents having bad heredity should have but few if any children. Unfortunately, it is precisely in the former group rather than in the latter that contraceptive methods are made use of.

Infancy.—Where there is a history of neurotic tendencies in one or both parents, it is wise to institute prophylactic measures early. A careful régime in infancy, important for all children, no matter what their parentage, becomes doubly important where there is the probability of neuropathic taint. We must insist upon regular feeding, see that nourishment of proper quality and in right quantity is given, clothe the child suitably, and provide for sufficient sleep and plenty of fresh air. Much good in

this direction will doubtless result from the campaign of education now being carried on by the American Society for the Prevention of Infant Mortality. Much harm is done by overindulgent, solicitous mothers who fondle, walk with, nurse, or rock a child every time it utters an unfamiliar sound or shows the slightest restlessness. Mothers and nursemaids should be taught to begin early to instill regularity of habits and to require obedience. A child very easily acquires habits—either good or bad; whether they be good or bad will depend almost wholly, when the brain is normal, on the parents and nurse.

Childhood.—In general, a similar régime should be continued throughout later childhood, with adaptations, of course, to the conditions of life during this period. It is during childhood that the human being is most impressionable and plastic; at this age, correct habits of living are easily established, but, unfortunately, defective modes of living are just as readily learned, and these may, later, be serious obstacles to any effort directed toward nervous and mental hygiene. Every physician is familiar with the overindulged, self-centered, domineering child, who really directs the affairs of the household and must have its own way in all affairs of life, the child that, on the slightest opposition to its will, may exhibit any one of a variety of moods and passions, from sulkiness to the most violent outbursts of temper. How often, in such a case, a naïve, misinformed, and perhaps neurotic mother, or father, will make all manner of excuses for the child, saying that it has always been delicate, that it does not feel well, or that it inherits its disposition and cannot behave otherwise. Taking the child to task, admonishing it, the parents tell you, only makes things worse. It may be argued that such a child is already in the nervous class, and to a certain extent this is true, the earmarks of "nervousness" are present, but there is usually ample time even then to overcome the manifestations by the application of carefully selected prophylactic and therapeutic principles.

Children that manifest a preternatural emotivity should always cause concern to the observant family physician. A child that has too lively vasomotors, reddening or turning pale on slight provocation, or one that goes too easily from exuberance to sadness, will attract his attention and lead him to give special directions to the parents regarding supervision, physical, mental, and moral.

All children should be taught obedience, self-denial, stoicism, and responsibility. Strict attention should be paid to rest, sleep, fresh air, moderate exercise, the daily sponge-bath of cool or cold water, and to the diet and bowels. The use of coffee, tea, and stimulating drinks should be prohibited. Self-abuse should be strictly guarded against. It may be even necessary to place a very nervous child away from home in the care of some one other than an immediate member of the family, though, at home, a well-chosen governess or an intelligent nurse may accomplish

much. Whoever takes charge should be kind, firm but not harsh, truly sympathetic without indulging an abnormal craving for sympathy. If possible, she should have had some experience in dealing with nervous or ill-directed children. Excitement, competitive games, and overvigorous exercises are particularly harmful to nervous children.

Education in school is an important feature in the lives even of nervous children. It should not, as a rule, be begun before the seventh year, and great care should be taken to avoid forcing nervous children beyond their strength at school. If conditions in the family circle are decidedly unfavorable, it will be wise to have the child educated away from home, say in a good boarding-school, where system, regularity, obedience, and outdoor exercise form a large part of the educative process. An "only" child is in great danger of being spoiled and of becoming nervous, for children need the educative influences of companions of approximately their own age. The "only" child should in some way be thrown regularly into contact with other children.

In connection with functional nervous disorders in childhood, the physician may consult L. G. Guthrie's *Functional Nervous Disorders in Childhood,* V. M. Hillyer's *Child Training,* L. F. Barker's *Principles of Mental Hygiene Applied to the Management of Nervous Children,* E. Evans' *Problems of the Nervous Child,* G. W. Jacoby's *Child Training as an Exact Science* and I. S. Wile's *Mental Hygiene During Childhood.*

Adolescence.—If the preceding prophylactic measures have been faithfully observed, good habits should have been sufficiently established to carry the person safely through the adolescent period. There are certain dangers, however, attendant on the awakening of sex consciousness: the transition from childhood to manhood, or womanhood, demands careful supervision. The physical and psychical changes of this period are more or less impressive, and often make their appearance as a surprise to a wholly uninformed child. This is particularly true of girls, who, because of false modesty and their mothers' aversion to matters sexual, have never been told about the normal process of this period of life. Many children are away at boarding-school during this period, and the realization of the sexual side of life comes as a shock, especially to sensitive girls. Mysterious and vague ideas are engendered; self-inspection, masturbation, or other abnormal practices may get a start. Children approaching puberty should be given, in advance, a plain, sensible explanation of the evolution of the sex instinct.

The physical, mental, and moral education of the adolescent requires special attention. When a neuropathic temperament exists, mental and physical work should be subject to strict regulation, and the former should occupy a secondary place. Well-chosen, systematic exercise should be urged. Rowing, swimming, tennis, running, riding, and gymnastics under a trained instructor are often beneficial. A system of disciplinary

physical training like the so-called "dromotherapy" of Burlereaux, at Auteuil, in which the individual needs are carefully studied and the exercises prescribed with an intelligent regard for grade, speed, and duration can be recommended highly.

If the child is to be educated away from home, the *choice of a school* is of importance. If possible, a school should be selected in which a certain amount of physical exercise is compulsory; it should be located, preferably, in a smaller town, or a rural district. In France, the Academy of Medicine has demanded a certain supervision of the physical education of school children. Within the last few decades, there has developed, everywhere, a greater regard for the necessity of bodily development. In England, Eton, Harrow, and many of the older institutions of learning, are located in the smaller towns, or within easy reach of the country districts. The hours of study have been shortened, and the more moderate athletic games occupy a prominent part in school life. In America, preparatory schools, state universities, and many other seats of learning form, not infrequently, nuclei about which small towns develop. In such environments, there are fewer distracting influences; teacher and pupil are more intimately associated, and the chief diversion is usually some form of outdoor sport. Many young boys who have failed to learn the lessons of obedience, punctuality, and respect at home show marked improvement after a shorter or longer residence in one of our preparatory schools in which military régime is an essential feature. The problems of this time of life are well described in Stanley Hall's volume *Adolescence,* and the book may be read with advantage by all who are interested in the prevention of nervous disorders.

In the education of youth, care should be taken to combat sentimentality, timidity, hypersensitiveness and indecision. In the choice of a career, the natural powers of the person as well as his environmental opportunities should receive due consideration. Self-confidence should be developed and maintained by suitable adjustment of activities within limits set by heredity and surroundings. Stewart Paton's suggestion that college students have free access to an adviser endowed with common sense and trained in psychiatry is worthy of serious consideration by educational authorities. There is a tendency in recent years for large schools to employ experienced medical men.

Adults.—Effective prophylaxis in the adult is a much more difficult problem.

In the hereditary types, unless rigid precautions have been employed early, the abnormal states have most likely made their appearance by this time, and we have to do with the treatment of an established neurosis, rather than with its prevention. Should, however, the person have reached adult life safely, it becomes necessary to protect him, guided by knowledge of his personality and his ancestry, as far as possible from the

abnormal or indiscreet methods of living that are most likely to undo one burdened by a neurotic temperament.

In the attempt to lessen the acquired neuroses of adult life, the physician enters a more favorable field for the application of preventive measures. If any primary state—visceroptosis, anemia, status lymphaticus, defective metabolism, chronic infection—prone to be associated with neurosis be detected, it should be corrected. Overwork, worry, and a sedentary life should be avoided. The overambitious should be held in leash, and those subject to strong emotions and passions educated to self-control. Social, or intellectual, aspirations may, for a time, have to be discouraged. Convalescence from infectious diseases should be particularly guarded; this is to be especially advised after influenza, typhoid fever, and malaria.

The engagement period is one of great strain; "premarital neurasthenia" is its expression. The marriage ceremony is, in itself, a most disconcerting affair to the self-conscious, the self-centered, the neurotic. The numerous preparations that must precede it; the anticipation, anxiety, and misgivings regarding the ceremony in public and the subsequent consummation of marriage, are very trying experiences for the neurasthenic. The physical side of the sexual relations often comes as a severe shock to a sensitive woman. Almost inconceivable as it may appear, it is undoubtedly a fact, that numbers of women enter upon marital relations wholly uninformed as to the nature and function of sex!

The neurotic woman should be carefully guarded during gestation and the puerperium. All depressing and exciting emotions should be avoided; fright, anxiety, worry, or chiding may at these times be very harmful.

Childbirth, in *primiparæ,* is always a trying experience; much assistance may be given to an apprehensive woman by a conversation beforehand; the more usual phenomena of delivery should be fully explained; the obstetrician should see to it that proper hygienic and dietetic measures are instituted; the prospective mother should be given a reasonable assurance of a happy termination of the pregnancy. A thorough examination by a competent obstetrician, in whose opinion the patient has confidence, is usually reassuring.

The menopause, or climacteric period, is known, even to the laity, as a critical time of life. Between forty and fifty, women not infrequently complain of "nervousness" that they attribute to the "change of life." No doubt the nervous symptoms in many cases can be avoided, or greatly ameliorated, by watchful, intelligent care, and by suitable physical and mental hygiene, during this regressive stage. Both men and women in the latter half of life will find much valuable information regarding its conduct in Stanley Hall's *Senescence* (1922).

Emotion as a cause of neurasthenia may have either an external or an internal origin. Thus, among the external causes, railway or motor

accidents, the sudden death of one near and dear to the person, a great financial loss, a dishonorable act by some near relative, are common examples. Sometimes, an unexpected joy will be operative—a proffer of marriage, a great bequest, a lucky turn in the stock-market—especially if it come to a mental make-up that cannot quickly and adequately adapt itself to the new situation. Among the *internal* may be mentioned the memory of an earlier shock, and the harboring of ideas accompanied by strong emotional tone (for example, the idea of death, of invalidism, of ruin, of dishonor); especially, when the mind does not adapt itself to the idea, but revolts against it and continually preoccupies itself with it, is the emotional result harmful. Such emotion is oftentimes followed by symptoms that the patient attributes to a local physical origin (for example, pseudo-angina, feelings of suffocation, epigastralgia, feelings of general anxiety, dyspnea, diarrhea, or pollakiuria); the physician without psychiatric training may, in such cases, easily overlook the psychic trouble antecedent to the physical complaint. It is very helpful to a practicing physician to know as a result of long acquaintance with a person what the ordinary degree of emotivity for that person is. The family physician has exceptional opportunity for learning the degree of intellectual control possessed by his patient; he, too, should be best able to make an objective report on the general character of a patient, for if he be alert to these things he will have recognized any lack of self-confidence, any hypochondriacal tendency, or any moral uncertainty, overconscientiousness, or excessive scrupulosity that may have existed.

The exciting emotional cause of a neurasthenic state should be diligently sought and its full avowal encouraged. Physical causes predisposing to pathological emotivity should also be sufficiently valued; it seems probable that influences like overwork, fatigue, and undernourishment help to create a favorable soil in which pathological emotivity grows. But to attribute the origin of a psychoneurosis to them alone, without consideration of the psychic factors, would be like trying to account for the origin of tuberculosis without considering the necessary presence of the tubercle bacillus. As Déjerine and Gauckler put it: "Sans émotion il n'y a pas de psychoneuroses. Sans la genèse des états nevropathiques, il existe toujours une cause émotive." Indeed, they define neurasthenia as a state constituted by "the totality of phenomena that result from the non-adaptation of the being to a continued emotional cause and from the struggle of the being for that adaptation."

Preliminary Therapeutic Reflections

Before prescribing any form of treatment for the neurasthenic and psychasthenic states, or even consenting to assume the direction and supervision of patients suffering from them, certain general factors that pertain to their therapy demand consideration.

Psychology a Valuable Adjuvant.—Neurasthenic and psychasthenic states, whether primary or secondary, congenital or acquired, are most certainly manifestations of abnormal psychic activity. What is a state of consciousness? How are ideas associated? Why do people think, feel, and act in more or less different ways under what seem to be precisely similar external conditions? In what degree is each of the several fundamental instincts represented in the patient before us? The exact physical answer to these questions may never be known, but the psychic facts themselves are accessible to analysis, and a study of psychology may help us to understand, in a general way, the laws to which these fundamental processes of our mental life are subject. Every one who intends to undertake the treatment of abnormal nervous and mental states should familiarize himself with at least the elements of psychology. Individuals differ, perhaps, more in their mentality than in their external physical features—in fact, individuality itself is largely a matter of psychic potentiality. A normal heart sound, a normal pulmonary resonance, or a normal respiratory murmur are capable of demonstration; the physical facts are sufficiently constant to furnish us with a standard that we designate as normal. We may also know fairly well how one with a sound mentality will act under ordinary circumstances, but we cannot know the thoughts and feelings that are aroused in another, for we can never appreciate fully the total background of experience of another. In no two patients suffering from functional nervous disorders are the psychical or the bodily conditions exactly alike; we do well on meeting them to keep one of Beard's aphorisms clearly in mind, namely:

"Each case of neurasthenia is a study in itself. No two cases are alike in all details, If two cases are treated precisely alike in all details from beginning to end, it is probable that one of them is treated wrong."

A Correct Diagnosis the First Essential.—From a therapeutic standpoint, the nervous symptoms may be classified as mild, or moderate, but we should never be satisfied with the mere diagnosis of the existence of a neurasthenic or psychasthenic state. The diagnostic study, on both the physical and psychical side, should be thoroughgoing, and should consider not only the possibility of anatomical lesions, but also, and more especially, the pathological physiology, the abnormal psychology, and the etiology. In each case, every effort should be made to discover the presence of any abnormal physical condition that may be a contributory factor. If detected, rational treatment must be directed toward correcting it. Not infrequently a neurasthenic or psychasthenic state may be detected, or at least surmised, the moment a patient enters the consulting room. His attitude, demeanor, manner of entering the room, and method of relating

his symptoms all contribute to the diagnosis. But even though the nervous phenomena may be outstanding, the dangers of "snap diagnosis" and hasty conjectures should be remembered; they too often lead to actual error; and, moreover, even could one be sure, a diagnosis announced before a thorough physical examination has been made makes an unfavorable impression upon these victims of nervous instability. Neurasthenic and psychasthenic states, as primary conditions of the nervous system, should be our last, rather than our first, consideration. Every nervous patient should be approached with an open, unbiased mind, eager to detect some tangible cause of the symptoms, but, at the same time, conservative in its judgments regarding causal relationships. In practically every case, a careful research will reveal the existence of some emotional experience to which the personality has been unable to adapt itself.

A careful history should be taken, and a thorough physical and mental examination made. This is often impracticable at a single office visit, and may entail much work, including several conversations and the making of many physical and laboratory tests. For this reason it is advisable to have such patients, and particularly those who do not live near by, enter a general hospital for a few days, where a thorough study, including the various special examinations, may be made. Should some minor physical abnormality be detected, say an infected sinus, a tender ovary, a sensitive prostate, a variable gastric acidity, great caution should be exercised in assigning to it an etiological rôle; unless we are perfectly sure of a causative relation, too emphatic a statement regarding cause should not be made to the patient. An unguarded opinion, thoughtlessly expressed, often serves merely to supplant one pathological idea by another equally as tenacious; occasionally, it is to be feared, physicians are, in such cases, led to institute useless, and even harmful, local treatments, when they would have done far better systematically to have neglected local symptoms and to have directed their attention almost wholly to general upbuilding treatment and to psychotherapy. We feel that, in this connection, a word of caution should be said, too, about operative procedures in neurotic states.

Surgery and the Neuroses.—Specialization in medicine has its drawbacks as well as its advantages, and the neurotic, especially, are not infrequently the victims of "overspecialization" and injudicious surgical interference. A narrow "specialist," with inadequate ability, training, or experience, may be tempted unwisely to anchor a "floating" kidney, to cauterize a slightly enlarged turbinate bone, to shorten the mesentery of a slightly prolapsed viscus, to cut out the colon for constipation, to dilate and curet the uterus for a menstrual disorder, to cut an eye muscle in the faulty convergence of hyperthyroidism, to apply cumbersome apparatus to a "nervous" joint affection, etc. Of course, neurologists and internists are also sometimes blameworthy in overlooking, or underestimating, local

defects that are really important. Medical judgment may be sorely taxed in a given case. Even in outspoken organic disease, it is safer, sometimes, to institute general measures for a time, and to treat the patient's neurotic state until sufficiently improved later to undergo operative treatment, if necessary, without serious risk of augmenting the nervous condition. The decision of such matters requires careful and unselfish consideration on the part of the physician and surgeon. The most conscientious men—internists, surgeons, orthopedists, rhinologists, gynecologists, neurologists, etc.—will sometimes err. We should all of us remember that specialization tends to contract the visual fields, to lead to the old fallacy of attempting *aus einem Punkte zu kurieren*—to cure everything by treating one part! First, let us avoid all unnecessary interference. If operation be decided upon, let it carry with it a strong conviction that it will be followed by relief. Careful postoperative care is also an essential feature in neurotic patients. James G. Mumford, in a paper read before the American Surgical Association, adduced some interesting observations upon this subject. He reviewed the histories of 500 patients, eight years after their discharge from the surgical service of the Massachusetts General Hospital. Of this number 129 could be communicated with; he concluded from their reports that if there were more regard for postoperative care in surgical cases, and if a longer period of personal supervision were maintained, there would be fewer instances of semi-invalidism following upon sojourn in the surgical wards in our general hospitals. Patients might fare better if busy surgeons would, more often, turn over patients in convalescence from operations to their medical colleagues for supervision.

Selection of a Therapeutic Régime.—After coming to a conclusion as to the relative importance of any physical defects discovered in a "nervous" patient, and in how far we are to have recourse to general measures in combating the neurasthenic or psychasthenic state, we must ask ourselves the question: How can we best apply our therapeutic principles to the particular patient before us? The answer to this question will depend largely upon a number of circumstances: the severity of the symptoms, the sex, the state of the patient's domestic life, and the patient's financial condition. Though we may have positive ideas as to what should be done, were the patient to be put under the very best conditions, it may easily be that such conditions are more expensive than the patient can afford.

Thus, if the patient be a male, upon a small salary, and his income is the only source of revenue for a growing and dependent family, the customary hospital, sanitarium, or rest-cure treatment, with the additional expenses of a physician's fees, may be wholly unsuitable. The mere consciousness of the fact that a prolonged course of therapy in these circumstances means hardship for those dependent upon him would only aggravate his burden, as the expense and loss of income would be a constant

source of worry. In such instances, from the more elaborate methods of treatment, measures should be selected that are compatible with the patient's social and economic condition.

If the symptoms are not very severe, and especially when the features are psychasthenic rather than neurasthenic, a great deal of benefit frequently follows upon merely the thorough preliminary study of the case. This is often seen, when, after completing the examination, we tell the patient frankly, and in simple language, the nature of his ailment. A patient may be greatly relieved when, after a thorough physical examination has been made, he can be told by his physician that no abnormality outside of a functional disturbance of the nervous system has been discovered that could account for his symptoms; that, though this is true, it is realized that he is ill, and that his symptoms are not imaginary, though they may be largely psychical, and due to misrepresentation of purely normal stimuli acting upon an overstimulated or exhausted nervous system. One must, of course, use the words "psychical" and "mental" cautiously, lest he excite fears of serious mental disease or insanity. It is especially helpful to a patient if the physician can conscientiously say that the symptoms seem to him to indicate a form of nervousness that is curable. Such a conversation, alone, in many cases accomplishes much, for it assures the patient that his suffering is understood, allays his fears, and inspires confidence and hope of recovery. When actual organic visceral disease is found to exist, and it, in the judgment of the physician, has contributed to the nervous symptoms, the facts should be explained to the patient, care being taken to excite no unnecessary alarm or apprehension. If the patient can be led to make a frank and full avowal of the emotional experience that has been, perhaps unconsciously, the main cause of his nervous state, the best possible start will have been made. Treatment of a case should be instituted only on condition that the patient's confidence has been gained, and that he is willing to follow out instructions faithfully. In some instances in addition to the psychotherapy that must always be our main effort, a short vacation may suffice, or even a continuance of ordinary occupation with diminution in the amount of work, along with improved hygiene. An increased amount of rest, regularity in meals, sufficient sleep, an abundance of fresh air, mild exercise, attention to the bowels, and a cold sponge-bath in the morning, may all be helpful. Sometimes the physician does well to furnish a written schedule, outlining the way in which all the hours of the day are to be spent. Women often do well under the modified rest treatment here suggested, and many of them, even among the poorer classes, find it possible to arrange their time according to a program made out by the physician. In certain instances it may be wise to have the patient removed to the home of a relative, or a friend, who is able, and willing, to aid in carrying out directions. It is possible to make use of this method of treating pa-

tients in a neurological out-patient department. This treatment has been shown by experience to be very satisfactory as a form of therapy, and has also served as a helpful means of instructing medical students. Thus, after a patient has been established in her new surroundings, some one among the third-year students who is interested in this class of patients may be selected to take charge of the case, and to see that instructions are carried out; the student's visits and the management of the patient must, of course, be under the supervision of a member of the dispensary staff. There are few circumstances, perhaps, more prone to shake a student's faith in the efficacy of therapeutics than the witnessing of ordinary "dispensary treatment," and its utter futility, in the majority of the neurasthenic and psychasthenic states. On the other hand, the results obtainable by the method referred to above, which insures personal contact and continued observation under more favorable conditions, are most gratifying to patient, student, and instructor. Medical students should have larger opportunities than have hitherto been available for the study of the psychoneuroses and for gaining experience in the practice of scientific psychotherapy.

Where financial difficulties are not too restrictive, many adaptations, and modifications, of partial rest treatments will suggest themselves to the thoughtful physician. Of course, in cases where expense is a minor consideration, all measures that add to comfort, and facilitate cure, may be employed.

Continuance of Occupation.—Whether a patient's occupation shall be temporarily suspended, or not, is an important matter; a decision is not always easy, requiring, as it does, the closest scrutiny of personal characteristics, and mode of life. Though no generally applicable rule can be laid down, it may be worth while to refer to certain general principles that may, on occasion, be helpful in determining the course to be adopted.

1. If the particular form of occupation be an etiological factor in the neurosis, the work may not only have to be suspended, but, perhaps, have to be abandoned altogether; this is especially true if his occupation expose the patient to some chronic form of intoxication. There are, too, certain intellectual pursuits and professional vocations that appear to be incompatible with the welfare of certain neuropaths. Medical students and physicians, on discontinuing their work temporarily owing to imperative ideas or fears, sometimes find, upon resuming it, that the obsessions, phobias, or impulses are so intimately connected with certain phases of their work that resumption is impossible. We recall, in particular, the case of a young surgeon, intellectual and practically skillful, who, very early in his career, was forced to discontinue his operative work because of an absurd, but strong, impulse to spit into the wound just as an opera-

tion was being completed. Fortunately, he never yielded to the impulse, but it was so disturbing that he chose another form of medical work and, we are told, is making some progress.

2. Not only should the character and etiological bearing of the occupation be regarded, but, what is equally important, the manner in which the work is performed. Some persons do not know how to work properly. Many are spasmodic, irregular, temporarily extremely intensive, actually going on an intellectual, or occupational, "spree" of several days' or weeks' duration. It is necessary to teach these to perform the day's duty well, to adopt the maxim of Wilhelm Meister and "do the thing just ahead," and to leave to-morrow to take care of itself. There are others who, although occupying some minor position, overestimate their responsibility, and feel that the larger problems and destinies of their employers are entirely within their keeping. This attitude is sometimes a symptom, a form of "overconscientiousness," but it may also pertain to one particular form of occupation, so that both the symptom, and the occupation, need attention.

3. The third general consideration regarding continuance of occupation has to do with the patient, the severity of his symptoms, and the degree of fatigue and exhaustion manifested. As Forchheimer, Savage, Ziemssen, and others have emphasized, it may not be necessary in mild, or moderately severe, cases to discontinue the occupation. It will be well to have the patient take a brief rest, completely away from business or, if this be impracticable, to spend the week-ends away from home and business affairs. In most cases it is, however, necessary rigidly to limit the amount of work, and to prevent work at full speed. It is, moreover, essential to see to it that the leisure is spent in a profitable, hygienic manner, preferably in some form of outdoor exercise. Riding, hunting, walking, golf, and gymnastics may be recommended. If insomnia and incapacity for work are prominent symptoms, discontinuance of the occupation, at least for a time, can scarcely be avoided.

4. In all the *severer forms of psychoneurosis,* the patient should be removed entirely from his ordinary occupations and his usual surroundings. He should be placed in a hospital, sanitarium, or nursing home, where he may have the best form of *psychotherapy,* together with its necessary adjuvants, namely, *isolation, rest,* and *abundant food.*

Requirements in the Physician.—It has been stated that a physician's success in general medical practice depends largely upon his ability to treat, successfully, patients suffering from neurasthenic and psychasthenic states. There is much truth in this saying. For, in the first place, a large percentage of every general practitioner's following is made up of this class of patients, and, in the second place, the faculties that insure success in the treatment of neurotics are of great help, also, in the management of

many distinctly organic diseases. One attribute, apparently essential in physicians who have this success, is the quality of deriving genuine pleasure from the work of restoring such patients to health. If the physician be not interested in neurology, and especially if he be impatient with the complaints of the functionally nervous, he will do well frankly to confess the aversion to himself, and refuse to assume the responsibilities of treatment of this class. How frequently the remark is made, "I do not understand how Dr. So and So can spend his time fooling with nervous patients." Without interest in, or understanding of, nervous patients success in their treatment is scarcely conceivable; thus approaching them a physician may fail really before he has commenced.

The physician who will work successfully among the functionally nervous should be broadly educated, refined, sincere, honest, kind, firm, and adaptable. Whatever the patient's age, station, or race, the physician should be able to see things from his point of view, to put himself, to a certain extent, in his place, and to command his respect and confidence. Not every one possesses the kind of personal magnetism that makes the patient willing to lay bare before him the innermost secrets of his life. Likes and dislikes, personal attractions, and repulsions, depend upon a whole series of elements in the personality; they are often instinctive—matters of first impression. Some persons immediately appeal to us, some make little or no impression upon us; still others at once excite in us a feeling of aversion. Generally speaking, one is more apt to be successful with a patient whose social condition, environment, and habits of thought and life belong to a circle not too remote from that in which he lives and moves himself. The first essential is that the physician gain the patient's confidence; if this cannot be secured, it may be better not to assume the responsibility of the treatment. For securing the necessary mental relationship, Bouveret emphasizes: (1) a thorough examination; (2) a real interest in the patient's suffering; (3) an intelligible explanation of the nature of his malady; (4) repeated reassurance and prospect of cure; (5) a relation of the success that has attended the treatment of other similar patients—where possible, selecting, as examples, instances in which the symptoms were still more severe; and (6) never making the mistake, when a patient is ill, of giving him the impression that you do not believe his suffering to be real.

It is usually easy, even for a young physician if he has learned how to do it, to gain the confidence of a neuropathic patient at the first interview, for the neuropath readily gives his confidence to a physician that shows an interest in him, that will listen patiently to his complaints, and that will show by his questions and his statements that he has a real understanding of, and sympathy with, the sufferings of the psychoneurotic. Great care should be taken not to commit one's self to a diagnosis, to a prognosis, or to a form of therapy, before the patient has been thoroughly

studied from all sides—physical and psychical. Not only should the patient be encouraged in the beginning to mention all his complaints, to relate all his experiences with former treatments, and to give expression to his own theories of his condition and its causes, but the physician should go farther and inquire specifically about all the bodily and mental functions, including especially those to which the patient himself has made no reference as well as to those he has specifically emphasized. Only in this way will the patient be convinced that the physician's examination has been thorough and complete. Moreover, full notes should be recorded of the patient's statements and of his answers to questions, for these notes may prove to be of the greatest value to the physician later on in his therapeutic management of the case. The physician should never stop short of the most important part of the questionnaire, namely, that bearing upon the emotions, or worries, that have been the exciting cause of the neurosis.

He must not hesitate to inquire into the most intimate facts of the patient's life, including his love, his religion, and his philosophy. He will of course vary his interrogatories with the character, the mental make-up, and the education of his patient, though he will not forget that the fundamental instincts are common to all human beings and that the thoughts, emotions and acts that pertain to each instinct are similar in all—that "the captain's lady and Julia O'Grady are sisters under their skins!"

Confidence once established, care should be taken that it be not destroyed. Occasionally a physician's resources are taxed to the utmost. If the patient be educated, engaged in some intellectual pursuit, or have some knowledge of affairs psychical, it requires most delicate tact, the guarded use of language, apt resourcefulness, and, above all, unswerving honesty, to maintain intellectual and moral control. Once a patient detects the physician in error, or hears conflicting statements concerning his condition, he is likely to be shaken in his faith. He must be made constantly to feel that the physician knows more about his condition than he. This faith-attitude is not always easy to retain, for a patient feels that his physician has never seen any one suffer as he does. How can any one know more about a state that he has never experienced than one actually suffering from it? is the question that is often asked.

After a regimen has been decided upon, definite, positive, and accurate directions should be given, and, unless there be positive indications for changing them, these should be rigorously enforced. Firmness, judicious sympathy, kindness, patience, and optimism are needed in the physician, if the patient is properly to regard his instructions. Oversolicitude should be avoided; ridicule and sarcasm are almost never necessary. Further, once a psychical state has been carefully explained to the patient, the physician does well, as a rule, to decline to discuss it at great length. It is, moreover, not wise to greet the patient, every time one enters the

room, with "How are you feeling to-day?"; it is more helpful to teach the patient to ignore symptoms as much as possible; cheerfulness and hope should be inspired.

After some experience, the physician learns how to use the different forms of psychotherapy and when to apply each form. He must know how and when to command, how to lead a patient to forget, how to change the course of ideas by suitable distraction, above all how systematically to re-educate the patient so that he may lead as nearly as possible a normal life. Each patient's personality must be studied thoroughly and the treatment varied accordingly. Age, sex, character, education, social opportunities, religion—all should be considered when deciding upon the general course to be followed and the detail of management in a given case.

Requirements in the Nurse.—Those patients that require the special services of a trained nurse should have the attention of one suited to the needs of the individual, not of one chosen at random. In general, the requisites of a good nurse for the care of neurasthenics are, in a measure, similar to those of the physician. The nurse should be cheerful, personally attractive, absolutely cleanly, neat, patient, and tactful, and she should have plenty of "common sense." Nurses that have had merely a general hospital training may not be entirely satisfactory, for such nurses, accustomed to the care of surgical or "acute" medical cases, have had, as a rule, but little experience with neurotic patients, and cannot tolerate their apparently absurd fancies and ideas. Nurses, like doctors, often exhibit a preference for the care of certain classes of patients; one should be selected that is interested in the care of, and the study of, neurotic states. It is, of course, essential that physician and nurse loyally coöperate in the maintenance of the regimen; the nurse should have respect for the physician in charge, and under no circumstances belittle his opinion, or contradict his statements, to the patient. The nurse should sedulously avoid giving the impression that any of the "discipline" originates with her; the "rules and regulations" will be submitted to more readily when they are understood to be the physician's orders. A nurse's attitude toward a nervous patient should always be one of friendliness and helpfulness; above all, it is desirable that she herself be free from any neurotic tendencies; that she be thoroughly healthy in body and in mind. If the case be a protracted one, it may be advisable to change the nurse occasionally, even when no incompatibility exists. Thrown together so intimately and continuously, mutual boredom is not surprising; moreover, the strain on the nurse is often too great to justify a continuance with one patient over a long period.

Where the physician notes an incompatibility of temperament in nurse and patient, he may change the nurse promptly; trained nurses now understand that this brings no discredit or censure with it.

If the patient has been cared for by a nurse, when she applies to the physician for treatment the question of retaining that nurse or of starting afresh with a new one should be considered. Each instance will require its own decision, though as a rule it is better to begin with a new nurse.

Generally Accepted Therapeutic Principles

According to prevailing medical opinion, neurasthenia and psychasthenia, aside from their primary causes, are looked upon as conditions of "irritable weakness" of the central nervous system. Fatigue and irritability are both prominent features, and they furnish, when wise attention is paid also to causes, a rational basis for therapy. Both fatigue and irritability suggest the need of *rest*—the essential element in all therapeutic courses prescribed for patients suffering from neurasthenia or psychasthenia. But continued rest means inactivity, and inactivity, if too prolonged, means deterioration of function. A fatigued muscle requires rest, and a rested muscle needs exercise. So it is with the nervous system. The treatment of these neuroses will, therefore, be considered in two distinct sections: (1) a section dealing with the *protection* of the central nervous system, or *sedative* treatment; and (2) one dealing with *exertion* of the central nervous system, or *stimulating* treatment. Certain more special therapeutic features, such as treatment in sanitariums, or in hospitals, by travel, by climate, etc., as well as the treatment of particular symptoms, will be separately discussed.

We must emphasize the fact, however, that he who relies mainly on physical methods of treatment of the psychoneuroses will fail very often. The physical methods of treatment are very valuable as adjuvants, but the main effort in treating neurasthenia and psychasthenia should be directed toward influencing the minds of the patients, that is, toward psychotherapy. This psychotherapy should rarely be one of argumentation; it should rather be one of creation of confidence in a physician, who will then lead the patient to have confidence again in himself. To succeed, a physician must be able to make his patient "like him"; sentiment is an important factor in the establishment of an atmosphere of confidence, for as Déjerine has well said: "Aucune idée n'est admise à froid."

Protection and Reconstruction of the Central Nervous System

Rest.—Though rest is generally accepted as an essential therapeutic agent for all patients suffering from neurasthenic states, opinions differ as to the degree of rest, the length of time required, and the method of administering it. Either mental or physical rest, or both, may be prescribed, and the rest may be partial or complete.

The value of rest as a therapeutic measure was mentioned by Beard in his first communication on neurasthenia; its real function in the treatment of the neuroses was not generally appreciated, however, until Dr. S. Weir Mitchell made known his method of treating these patients, and showed the world what could be done by means of systematic "rest cures." He recognized fully that rest alone was not sufficient. It tends to lessen the appetite and digestion; it may enfeeble the circulation; it induces constipation. For these reasons massage and a suitable dietary form a part of every "complete" rest treatment, and, as soon as possible, the principle of rest or protection is made to give way gradually to the principle of exertion or stimulation. Weir Mitchell also recognized the importance of psychotherapy in the treatment and was a master in the art of practicing it.

Partial Rest.—Partial rest may be variously adapted to suit individual needs, and is most useful in treating the milder conditions, as well as in ameliorating the symptoms of those who, though ill enough to justify it, cannot afford to discontinue all of their regular work. Such partial rest may vary all the way from a slight repose of an hour or so each day to a more exacting prescription to spend the greater part of the twenty-four hours in bed. The duration of and the hours selected for rest have sometimes to be adjusted to the requirements of some other obligatory routine. In many mild cases it may suffice if the patient retire an hour or two earlier than his wont, if he have his breakfast served in bed, and if he recline upon a lounge for half an hour before and after each meal. Usually it is well to have such a patient spend at first ten or eleven hours of the twenty-four in bed.

Absolute Rest.—By absolute rest is meant as complete rest of both body and mind as is possible; it necessitates, for a patient yielding to it, a more or less prolonged stay in bed. In the severest cases the patient may not be permitted to feed himself nor to rise even for urination and defecation. If complete mental rest is necessary also, *isolation* of the patient becomes necessary; all communication with family and friends may be temporarily cut off, and reading and unnecessary conversation for a time prohibited. These extreme measures, however, are used only in the severest cases; even where the symptoms are marked, most physicians of experience prefer some modification of a complete rest treatment rather than the unqualified edict.

Rest in bed has for its object two distinct aims: (1) to reduce physiological expenditure of energy to a minimum, and to permit the restoration of normal function in fatigued tissues; (2) to help gain the patient's confidence and to secure proper regard for the physician's instructions; in other words, to establish at the outset what is necessary for cure, namely, "medical obedience." Rest alone is often sufficient to relieve much of the feeling of exhaustion; along with suitable diet, it is a help in mak-

ing undernourished patients gain in weight. One should not, however, be led to think that, because a patient puts on fat, he is necessarily gaining in strength and in muscle tissue; we do not wish to make either obese people or athletes out of our neurotic patients, but rather to put all the tissues into a healthy state; this is why, after preliminary rest and abundant feeding, we have, later on, to consider most carefully the matters of exercise, and of suitable balance in the diet of protein, carbohydrate, fats, salts, vitamins and water.

The bed should not have a feather mattress, should be inviting, clean, and of moderate firmness. The room should be well ventilated, the clothing light and suitable for the season and temperature. If the bed can be run out on a porch in fine weather, all the better.

Rest in bed is clearly indicated for all patients that show real exhaustion or evidence of marked malnutrition. Extreme irritability and emotional outbreaks are also indications for rest. Bouveret advises rest in cases of cerebrasthenia, and more particularly in those of myelasthenia, where backache, pains in the extremities, and gastric symptoms are pronounced. Ziemssen, Buckley, and Godlewski all suggest that, in persons with "wornout" minds without marked somatic signs, and especially the fat, robust-looking, normally digesting patients with neurasthenic complaints, rest in bed is rarely indicated, or, if at all, only partial rest for a time. Charcot's type of patient, which he characterizes as *l'homme aux petits papiers,* will often do better with only moderate rest, combined with a prescribed routine of judicious exertion.

The duration of rest, the time of year best suited for it, and the degree of it are all largely matters for individualization. A rest cure is most easily carried out in the cooler months of the autumn or spring. When rest has been decided upon, the maximal rest and the more rigid restrictions to be used in a given case should be given at the very beginning of the treatment. It is better, and far easier, to reduce the rigor of one's rules after a time than it is to increase it. It makes a better impression upon the patient, too, for an increase of liberty encourages the idea of improvement; the "conviction of cure" is strengthened when some of the bars can be let down because of progress. The duration of the rest necessary will depend largely upon the actual progress the patient makes; no definite time should be set at the beginning, or, if any "guess" be made, it should err on the side of overestimation. Some patients will not require more than two, four, or six weeks; in very severe cases months may be necessary.

It should be remembered that in nearly every case it is mental rest that the patients need even more than physical rest. The problem of how to secure this mental rest is the one that throws the heaviest tax on the physician. In severe cases it can scarcely be secured without isolating the patient.

Isolation.—Like rest, isolation may be partial or complete. It has for its main object the removal of the patient, as far as possible, from all sources of external irritation; it serves also to increase confidence, and to make the physician's control over the case more easily possible. In extremely irritable and hypersensitive persons, upon whom even normal external stimuli, owing to distorted perception and abnormal association, yield exaggerated reactions, there may even be a personal desire for separation from the external world; temporary isolation is for them a real relief. Though the majority, perhaps, of patients may be successfully treated without isolation, there are some in whom therapy will almost surely fail, unless the patient can be wholly separated from his or her ordinary surroundings and associates.

Partial isolation away from home should be prescribed in most cases where rest in bed is indicated. Separation from overanxious and oversympathetic or undersympathetic friends and relatives is most essential. Many neurotic patients feel that their complaints are misunderstood by the family, that they are neglected, or even abused. And it is not uncommon actually to find patients reproved, scolded, and censured for symptoms that they are wholly unable to suppress, or in other instances to see patients humored, encouraged, and excused from all responsibility—to their detriment.

The need of isolation, then, depends somewhat upon the conditions that exist in the family circle. If it be thought necessary to insist upon it, the physician, while it is being carried out, should not forget that a large share of his work consists in reëducating, not only the patient, but also other members of the family; he must work for a readjustment of conditions in the home.

Letter-writing between patient and family may have to be largely restricted, or even forbidden altogether at first, though the arrangement should always be made that, if anything goes wrong at home that the patient really should know, knowledge of it will not be withheld. Visitors, provided they have a proper understanding of the patient's condition, may later on be permitted once a week, but only those who are known to be discreet in their conversation; even these visitors may stay for a short time only. It should be remembered that a single visit, by an ill-chosen person, may undo a week's work of psychotherapy!

In some few cases, isolation may be undertaken at home, but with the distinct understanding that, in addition to the nurse, only one member of the family, or one attendant, chosen by the physician, is to have access to the patient's room. Isolation without a nurse or a companion would in most cases do more harm than good.

Absolute isolation with a nurse is likely to seem to the patient to be a trying ordeal, and it should be reserved for the severer cases, in which the emaciation, irritability, or hypersensitiveness are pronounced enough to

demand radical measures. As a matter of fact most neurotic patients quickly adjust satisfactorily to isolation.

In some psychasthenic states, it is better not to isolate the patient, particularly if it seem probable that it will encourage introspection, self-analysis, or despondency. When convinced, however, that isolation, partial or complete, is necessary, we should not be deterred from prescribing it by the patient's objections, or by the statement that she could not endure separation from family and friends. A patient can usually be made to see the wisdom of isolation, when it is needed, by a few well-chosen, kind remarks, the physician giving the reasons first, and commenting upon the efficacy of isolation in the treatment of similar cases in his experience.

Isolation should be looked upon, not as an end in itself, but as Déjerine and Gauckler emphasize, only as a means to an end, a means absolutely necessary in many instances for the continuous and successful application of psychotherapy.

Diet.—Diet in the treatment of neurasthenic states has been the subject of much discussion; many fanciful dietetic measures founded upon various conceptions of the pathology of these states have been advocated. Autotoxemia from the gastro-intestinal tract, changes in vascular tension, gout, and disordered metabolic states, including the *arthritisme* of the French school, all have had a part in influencing dietetic régimes. It would be just as irrational to formulate a specific diet for all neurotic patients as it would be to treat all cases of headache in the same way. Whatever may be one's view as to the etiology and pathology of psychoneurotic states, diet should be prescribed according to the individual requirements of the patient. In general, on the nutritional side, neurotic patients may be divided into two classes: (1) the lean, emaciated, underfed, so-called "wornout" class; and (2) the healthy-looking fat, ruddy, truly irritable type. French observers, especially, have supported this classification, recognizing two main types, on the basis of a study of vascular tension and of analyses of the gastric juice. Members of the first group usually exhibit arterial hypotension, atony of the gastro-intestinal tract, and hypo-acidity or even anacidity of the gastric secretion. In the second class arterial hypertension, gastro-intestinal restlessness, and hyperacidity of the gastric juice are often demonstrable. Although some who thus divide the cases are ardent supporters of the "rheumatic" nature of the neuroses, and have established dietetic régimes largely based upon this belief, this fallacy should not deter us from recognizing the usefulness of their observations upon blood-pressure and gastric function as helpful guides for prescribing dietetic measures. As far as our own studies upon the relation of vascular tension and gastric acidity to the two types go, they support the classification.

Dietetic measures may be instituted to secure physiological rest of

the alimentary tract; to adjust the food intake to certain abnormalities of the metabolic processes, and to regulate definite gastro-intestinal functions. In selecting a dietetic régime we should have in mind the state of nutrition of the patient, any gastric disorder present, as shown by a study of the gastric juice and of the motility, and the blood-pressure. Special indications for dietetic supervision include evidences of malnutrition, anemia, digestive disturbances, irregular or faulty habits of eating, metabolic diseases. As a rule, the fat, normally-digesting cerebrasthenic requires little attention to diet, other than measures suited to his vascular tension, or to reduction of the body weight. Often the alimentary supervision in neurasthenic states is less a matter of specific dietary, or departure from what a healthy person should observe, than an effort to reëstablish rational eating, educating the patient to enjoy normal amounts of the ingredients of any well-selected menu.

Diet may be quantitatively restricted in calories, or it may be qualitatively altered. Quantitatively, it may be temporarily reduced to a minimum, or it may be increased beyond the limits ordinarily required to maintain metabolic equilibrium, as in "forced feeding" or "superalimentation." Both of these methods may be, and usually are, employed at different stages in the treatment of a single case. Thus a restricted diet is used when we wish temporarily to secure digestive repose; in such cases it is common to begin with small quantities of milk, given often, without other food, for a few days or a week. In cases with marked gastro-intestinal atony, dilatation, and diminished gastric secretion, some care must be exercised in giving milk lest fluids further dilute an already impoverished gastric juice, favor gastric dilatation, cause diarrhea or constipation, and really starve the patient. In such cases it may be wiser to employ a mixed diet, moderately restricted at first, especially as to fluids, only small quantities of water being allowed with meals. Even though, as Hawk has recently pointed out, the ferments act better when water is taken with meals, still in gastric atony large quantities of water interfere with gastric motility. When gastro-intestinal symptoms are absent, or of minor importance, except for anorexia, the gastric juice being normal, certainly no harm, but distinct benefit, may be derived from a brief course of milk feeding. Ordinary milk may be given cold, or it may be given skimmed, boiled, or mixed with limewater. Patients often have a distaste for milk, asserting that they "never could drink milk"; then a little cocoa, tea, or coffee may be added, just sufficient to color it, if desired, though usually, on gentle persuasion, patients will take it plain, and, resting, find that they can digest it. By far the majority of patients can and will take milk, even in large amounts, if the physician request it, give his assurance that it may be taken without harm, and urge the patient to continue its use despite any symptoms that may follow its ingestion and that he may be inclined to attribute to it.

This preliminary "starvation diet" has the support of such men as S. Weir Mitchell, Dubois, Playfair, Allbutt, Starr, and others. Our own experience has led us to adopt it for a few days at the beginning of treatment in the majority of cases. It has seemed to us that patients gain more rapidly later, on account of it. Godlewski recommends it most heartily in cases with arterial hypertension. Our own experience has confirmed his statement that a period of only two or three days may suffice to cause a marked fall in blood-pressure. The empirical use of a preliminary milk diet as a rigid routine in certain institutional treatments, for every case admitted, is, of course, to be deprecated; but, judiciously employed, after careful study of the individual patient, it has its place, and should, in suitable cases, be prescribed without hesitation.

After the preliminary period of restriction, a general mixed diet may usually be given. It should be appetizing, sufficient to maintain nitrogenous equilibrium, easily digestible, and it should contain proper proportions of the essential elements—proteins, fats, carbohydrates, vitamins, and salts. If the patient be obviously underfed, an attempt should be made to fatten him; if he be wilfully overindulging himself in food, we regulate the amount, and reduce his weight. In the latter case Buckley advises the "Salisbury method," restricting the diet, for a time, to rump steak, cod fish, and hot water! The absence of carbohydrate, fats, and fruit from this diet makes it objectionable. It is better to use one of the diets for obesity. The patient should be weighed accurately once a week, and a weight chart should be kept.

Godlewski, paying much attention to the blood-pressure in cases of arterial hypertension, hyperchlorhydria, and motor restlessness, advises a restricted dietary, eaten alone, all external stimuli likely to cause reflex psychical irritation of the alimentary tract being reduced to a minimum. In hypochlorhydria with gastric atony and low pressure he advises meals with others, with plenty of psychic stimuli to the gastric secretions (table decorated; appetizing dishes). The company should be cheerful and agreeable, and all work should cease an hour before each meal. Déjerine requires this class of patients to eat under the direction of, and in the presence of, an attending physician who supervises the meal. Sir Andrew Clark emphasized eating slowly; "the mouth having thirty-two teeth, each mouthful should receive thirty-two bites." Fletcherism has had some vogue among neurasthenics, but excessive "bradyphagia" is not to be encouraged.

Forced feeding, after preliminary rest and preparation of the stomach, is, as has been said, particularly applicable to the thin, anemic, underfed type of patient. In most undernourished patients, three large meals should be taken, and in addition four to six glasses of milk and three to six raw eggs per day; the latter are best taken immediately after the three main meals, not between them. Forced feeding is often used for too long

a period, after it has ceased to be beneficial. In cases of undernutrition, when judiciously managed, for a proper length of time, it is of signal benefit. It is manifestly inappropriate for the robust, healthy-looking neurotic, already overburdened by excessive assimilation from a constantly overindulged stomach.

Qualitative dietetic restrictions, necessary in the neurasthenic states accompanying gout, diabetes, etc., can only be mentioned here. For the details the reader is referred to the special chapters dealing with these subjects. A few remarks bearing upon the relative proportions of the main constituents of dietaries in neurotic cases may be of help; comments upon some typical dietetic schedules that have been recommended also here find a place.

Proteins.—The general opinion has already been expressed that excess of proteins, of meats in particular, should be avoided. Bouveret advises that, in all cases with diminished hydrochloric acid in the gastric juice, highly seasoned meats should be prohibited. Collineau, who adopts the "arthritic" theory of neurasthenia, feels that the proteins should be reduced. Combe, of Lausanne, has advocated a diet, widely used upon the Continent, which is entirely meat-free. He designates it as a "farinaceous diet without meat," and suggests the following schedule:

7.30 A. M.—Thick soup, water, milk, biscuit, and butter.
10.00 A. M.—Farina with milk.
12.30 P. M.—Yolk of one or two eggs, *pâté alimentaire*,[1] purée of potatoes, pudding, toast, or biscuit, and butter. No water.
3.30 P. M.—Farina with milk.
7.00 P. M.—Same as at 12.30.
10.00 P. M.—Évian water; after ten days a baked potato is added.

This schedule is continued for from three to six months; during the treatment his patients, he asserts, show marked improvement.

Fats and Carbohydrates.—Beard advised the reduction of starches and sugars, but fed fats, oils, butter, and milk generously. Dana advises plenty of fats and nitrogenous foods, but is opposed in general to the establishment of any special dietetic régime. The farinaceous diet of Combe has been referred to above. General opinion favors a mixed diet for most cases, with a preference for quantitative rather than qualitative changes. In arterial hypertension with hyperchlorhydria, Godlewski advises a milk and egg salt-free diet with very little water during meals. Milk or mineral waters, however, may be given between meals; it is well in most cases, for a time at least, to prohibit tea and coffee.

In making a schedule we should remember that neurotic patients, self-

[1] *Pâté alimentaire*, made of milk and flour and cooked for twenty or forty minutes in salt water.

centered, apprehensive, and suggestible, are often afraid to eat; the details of an elaborately prepared dietetic schedule may only serve to fix their attention upon the alimentary tract and to increase a chronic dyspeptic invalidism. *As soon as possible the patients should be taught to eat sensibly of all easily digestible foods, regardless of inclination.*

The Weir Mitchell Method.—One of the most valuable protective measures we may employ is the course of therapy advised by Dr. S. Weir Mitchell, whose name has become inseparably associated with the "rest cure" treatment of neurasthenic and hysterical conditions. The essential features of the method are: rest, isolation, and diet (superalimentation), with massage and electricity to promote circulatory and muscular activity. It has been especially useful for neurasthenics that are anemic and emaciated; for these "fat and blood" must be made. As a rule, the more emaciated the patient, the easier he is to treat.[2]

In the severest cases, the patient is put to bed, made to rest absolutely in isolation, under the care of a nurse, preferably in some country district. Usually he is not permitted to receive, or to write, letters; even self-feeding may be prohibited. The patient is not permitted to speak of his ills to any one except the physician; reading and conversation are not allowed for a time. The diet, in the beginning, consists entirely of milk, skimmed, or peptonized, if necessary, or diluted with plain, carbonated, or limewater. For the first seven days 1 quart of milk is administered in the twenty-four hours. Thus, beginning at 7 A. M. and ending at 9 P. M., 4 ounces of milk are given every two hours; it is advised that it be slowly sipped. During the second week the total amount of milk in the twenty-four hours is increased to 2 quarts. Later, a light breakfast is added, and, within the following ten days, three full meals are permitted, with milk between the principal repasts.

Massage is usually begun on the fourth day, and is given gently, in the following order: feet, legs, back, chest, and abdomen; twenty minutes' duration in all. Within a week, the massage is given for one hour daily. Tapping and slapping are to be avoided, the massage consisting rather of stroking, kneading, and gentle rubbing. Electricity may be given along with massage, or may alternate with it. The induced current is applied to the spine and to the general musculature for ten or fifteen minutes daily. If any of the measures are to be dispensed with, electricity may be most readily omitted. After the stage of three full meals has been

[2] This is not always true, however. Recently, a patient seen by one of us died of starvation from refusal to eat or to be tube-fed. He had outspoken food phobias and bizarre ideas regarding what would agree with him. On one occasion, he requested broiled squirrel's brain, but it had to be the brain of a grey squirrel, not that of a red or of a black squirrel. He suffered, of course, from a delusional psychosis. At death he weighed only about 65 pounds.

reached, Swedish movements may be commenced. In some cases, cod-liver oil, a little wine, or iron and strychnin tonics may be administered. In Weir Mitchell's hands remarkable cures were obtained; no small part of his success lay doubtless (1) in his wise individualization of the treatment, and (2) in the accompanying psychotherapy, for which the richness of his personality made him unusually well fitted.

Weir Mitchell's method has been employed all over the world, notably by Playfair in England and by Binswanger in Germany. Many modifications and adaptations have been devised. Sample schedules, arranged by Binswanger, by J. K. Mitchell (son of Weir Mitchell), and by M. Allen Starr follow. Excellent accounts of the rest cure, by one who has successfully applied it in a large and varied experience, are available in the articles by F. X. Dercum in the *Physiological Therapeutics* of Solis Cohen, and in Musser and Kelly's *Handbook of Treatment.*

Déjerine and Gauckler Diet for Psychoneurotic Patients

These authors prefer a milk régime, either partial or absolute, for the majority of their patients undergoing psychotherapy. Déjerine asserts that true intolerance for milk does not exist in more than one patient out of two or three hundred. Admitting that bloating, bad taste in the mouth, diarrhea or constipation may at first be complained of, it is found that these symptoms last only a few days and may therefore be ignored.

Déjerine and Gauckler give hourly doses, for twelve hours each day. They give 250 c.c. per hour for the first day, that is 3 liters, and soon increase the amount to 3½, 4 or 5 liters per day, this maximal amount being reached by the eighth or tenth day of treatment. The patients gain rapidly in weight—1½ to 4 or 5 kg. per week.

This milk diet is continued until the patient's normal weight is attained, after which an ordinary wholesome mixed diet is given.

Feeding in Rest Cure Cases According to Binswanger

7.00 A. M.—Glass (250 c.c.) boiled milk, or cocoa made with half milk and half water; two or three biscuits or zwieback.

9.00 A. M.—Cup of bouillon; 2/3 oz. (20 gm.) meat; 1 oz. (30 gm.) Graham bread, or toast; 1/3 oz. (10 gm.) butter.

11.00 A. M.—4½ oz. to 6 oz. (125 to 175 c.c.) milk, with a tablespoonful of meat extract, or the yolk of an egg.

1.00 P. M.—2½ to 3½ oz. (80 to 100 c.c.) of soup with oatmeal, barley, or rice; 1¾ oz. (50 gm.) roast; 1/3 oz. (10 gm.) potatoes; ¼ to 1/3 oz. (7 to 10 gm.) vegetables; 2/3 oz. (20 gm.) sweet rice pudding; 1¾ oz. (50 gm.) stewed fruit.

4.00 P. M.—4½ oz. (125 c.c.) weak tea, coffee, or malted milk and two biscuits.

6.00 P. M.—2/3 oz. (20 gm.) of meat, which may be hot or cold roast, scraped raw meat, tongue, or ham; 1/3 oz. (10 gm.) Graham bread, or toast; 1/6 oz. (5 gm.) butter.
8.00 P. M.—4½ oz. (125 c.c.) soup, cooked with 1/3 oz. (10 gm.) butter and the yolk of an egg; oatmeal, barley, rice, etc.
9.30 P. M.—4½ oz. (125 c.c.) malted milk.

These quantities are gradually increased until, by the end of two weeks, the amounts of milk, cocoa, and soup are doubled and those of meat, bread, and butter trebled. Small quantities of fresh vegetables and simple puddings are then allowed. There are many cases in which such a menu can be prescribed from the beginning of treatment, particularly in the cerebral type of neurasthenia without marked emaciation or without marked gastro-intestinal disturbances.

Sample Full Rest Schedule According to J. K. Mitchell

7.00 A. M.—Cocoa, cool sponge bath with rough rub, and toilet for the day.
8.00 A. M.—Breakfast, with milk. Rest an hour after.
10.00 A. M.—Peptonized milk, 8 oz. (236 c.c.)
11.00 A. M.—Massage.
12.00 M.—Milk or soup, 8 oz. (236 c.c.). Reading aloud by nurse, half hour.
1.30 P. M.—Dinner. Rest an hour.
3.30 P. M.—Peptonized milk, 8 oz. (236 c.c.).
4.00 P. M.—Electricity.
6.30 P. M.—Supper, with milk. Rest an hour after.
8.00 P. M.—Reading aloud by nurse for half an hour.
9.00 P. M.—Light rubbing by nurse with drip sheet.

In addition to the above, he advises the following: 3 oz. (98 c.c.) malt extract with meals; 8 oz. (236 c.c.) peptonized milk with a biscuit at bedtime, and a glass of milk during the night, if desired. An occasional laxative (cascara, 10 to 30 drops, 0.61 c.c.) is administered, and later Swedish movements are added, to be done after the massage.

In milder cases partial rest, diet, occupation and diversion are prescribed, and a schedule is arranged so as to occupy most of the patient's time. As a sample régime, one suggested by M. Allen Starr may be given; changes may be made to suit individual needs.

Sample Schedule for Partial Rest Cure (M. Allen Starr)

8.00 A. M.—Small cup of coffee, with hot milk; or black coffee, if preferred. Hunyadi water if needed.
8.15 A. M.—Morning toilet.

8.30 to 9.00 A. M.—Breakfast: fruit, cereal with cream, eggs, bacon or fish, hot milk or cocoa.
9.00 to 10.00 A. M.—Rest. Letters read by nurse, or patient, after 9.30; glass of water.
10.30 to 11.00 A. M.—Bath; large bath towel under patient; blanket over patient. Nurse to bathe each part with soap and tepid water, or give patient a salt rub, or pack in place of bath with salt water affusion.
11.00 to 11.30 A. M.—Glass of milk or koumiss, or hot broth, or cocoa. Rest.
11.30 A. M.—Get up and dress for the day.
12.00 M.—Drive or walk.
1.30 P. M.—Lunch: soup, steak, or chops, with vegetables; salad; baked apple or fruit.
2.00 to 3.00 P. M.—Rest quietly, lying down, relaxed, but not undressed. Glass of water.
3.00 to 4.00 P. M.—Walk, drive, or see friends. Glass of milk or beef tea. Undress.
5.00 P. M.—Massage, at first gentle, later Swedish movements, or wet sheet pack, or physical culture exercises.
6.00 to 6.30 P. M.—Rest, alone, lying down.
6.30 P. M.—Dress for dinner. Glass of water.
7.00 to 8.00 P. M.—Dinner: oysters, soup, fish, game, or chicken; vegetables of any kind; salad, cheese, or fruit. No wine or coffee.
8.00 to 8.30 P. M.—Rest.
8.30 to 10.00 P. M.—Reading, or games.
10.00 P. M.—Bed, preceded by spinal douche, or drip sheet. Cascara tablet, 5 minims (0.31 c.c.) of fluid extract. Glass of hot milk, without or with trional, as required.

There is a group of still milder cases, for whom a still less rigid régime may suffice. The easily fatigued, somewhat undernourished, apprehensive patient, who is still capable of attending to the ordinary affairs of life, though they are felt as burdensome; tired housewives, and exhausted men of business form a large contingent. They complain of loss of power of concentration, slight irritability, fickle appetite, mild gastro-intestinal symptoms, and have a low blood-pressure. They may begin the day with a "tired feeling," or they may work in comparative comfort until four or five o'clock in the afternoon, when symptoms of abnormal fatigue begin to appear; the end of the day finds them exhausted in mind and body. Many of them cannot afford an expensive "rest cure" or even a prolonged rest at home. In case no organic disease exists, a more liberal schedule, but one that can and will be observed, may suffice for them. We have found the following very satisfactory:

7.00 A. M.—Cup of cocoa, or weak Oolong or China tea, with cream and sugar; or a glass of milk.
7.30 A. M.—Rise; 5 or 10 minutes' exercise with dumb-bells, Indian clubs, or Whitely exerciser; or, still better, the exercises outlined in J. P. Müller's *My System*. Cold sponge bath, 70° F. (21° C.), followed by brisk rub with coarse towel.
8.00 A. M.—Breakfast: mixed diet, followed by quiet reading of mail or paper. After breakfast, swallow one or two raw eggs.
9.00 A. M.—Customary occupation for the day.
11.00 A. M.—Glass of milk, 8 oz. (236 c.c.), and cracker.
1.00 P. M.—Lunch: not to be a "quick lunch," but a liberal meal, served at a table, preferably in the company of friends, and eaten slowly, during one hour, away from business. After luncheon, swallow one or two raw eggs.
4.00 P. M.—Glass of milk, 8 oz. (236 c.c.), and cracker.
5.00 to 6.00 P. M.—Riding, driving, walking, or gymnasium.
6.00 to 6.45 P. M.—Rest on lounge or bed.
7.00 P. M.—Supper; no tea or coffee. After supper, swallow one or two raw eggs.
9.30 P. M.—Warm bath, 95° F. (35° C.). Glass of hot milk and cracker.
10.00 P. M.—Retire.

A bitter tonic may be given (especially if the appetite be poor), and an occasional dose of cascara (minims v to xx—0.3 to 1.0 gm.—of the fluid extract) at bedtime. When the blood-pressure is low, suprarenal substance may be given after each meal. Massage and mild hydrotherapeutic measures may with advantage be introduced into the schedule in some cases.

Should the "rest cure" be decided upon, it is better, as has been pointed out above, to prescribe it *ad maximum* at the start, with all its essential components, and gradually to relax the rules rather than to approach it by degrees, since unsuccessful attempts with partial rest are apt to shake the patient's confidence in more restrictive measures. It should always be remembered that, in the "rest cure," physical measures are not *all* that is needed; the personalities of the physician, nurse, and masseuse are important; no doubt, in some of the instances in which "rest cures" have failed, negligence on either the physical or psychical side has been responsible. Further, some of the cases, taken to be "neurasthenia" at first, and which do not respond to a well-ordered "rest cure," doubtless turn out on longer observation to be either early stages of serious psychoses, or states symptomatic of organic disease.

The Dubois Method.—Though followers of Weir Mitchell have sometimes laid the main emphasis upon the physical effects of rest, isolation, and forced feeding, the founder of the method paid much attention also

to the psychic side of his cases. Attention to the latter has, since 1904, when Paul Dubois, of Berne, published his experiences in *The Psychic Treatment of Nervous Disorders,* become more general. Psychotherapy has been used indiscriminately by the charlatan, the faith healer, and the fakir from time immemorial; qualified physicians have also long used psychotherapy, sometimes consciously, sometimes unconsciously; Dubois and Déjerine are among those that have tried to establish its use on a solid basis. After having employed the Weir Mitchell method of treatment for a period of twenty years, they gradually came to attach less importance to the purely physical features of rest, isolation, and overfeeding, and to regard these measures more as a means of securing receptive psychical attitudes in the patient. Dubois modified gradually the degree of isolation and rest, gave up the use of massage and electricity, and employed vigorous psychic treatment in the form especially of persuasion and argumentation. Dubois is a believer in "determinism." The "will" is for him a product of hereditary endowment, education, and environment. Men are able, when taught how, to work toward ethical perfection. His motto is: "Gain insight, and strengthen the will, and you will be happy."

In the neurotic patient Dubois sees an abnormal mental state, due to faulty character, expressing itself in phobias, asthenia, depression, or hypochondriacal symptoms. Fear and cowardice are, for him, states to be surmounted. The therapy consists in ethical development, in the strengthening of the will and of the character. He depends chiefly upon bringing conviction of this to the mind of the patient. By means of an ethical transvaluation, the patient regains his self-confidence and his energy; by a sort of "moral orthopedics" he becomes cured of his neurosis!

Dubois finds a gradually increased milk diet *at the beginning of the treatment* a valuable accessory; we have used this part of his treatment frequently, and can speak most highly of it.

Milk Diet According to Dubois.—The figures in the table refer to the "doses" of milk. One dose equals 3 oz. (88.71 c.c.):

Milk Diet According to Dubois.

Day	Hours of Day								Total Amount in 24 Hours
	7 A.M.	9 A.M.	11 A.M	1 P.M.	3 P.M.	5 P.M.	7 P.M.	9 P.M.	
First	1	1	1	1	1	1	1	1	24 oz. 709 c.c.
Second	1½	1½	1½	1½	1½	1½	1½	1½	36 oz. 1,064 c.c.
Third	2	2	2	2	2	2	2	2	48 oz. 1,419 c.c.
Fourth	3	2	2	3	2	2	3	2	57 oz. 1,685 c.c.
Fifth	4	2	2	3	2	2	3	2	60 oz. 1,774 c.c.
Sixth	4	2	2	3	2	2	3	2	60 oz. 1,774 c.c.

The hours of the three future meals are marked by the larger quantities of milk at 7, 1, and 7 o'clock.

On the seventh day the regimen changes abruptly, and without transition he prescribes as follows:

7.00 A. M.—Breakfast: milk, 12 oz. (774 c.c.); bread, butter, honey, or preserves.
10.00 A. M.—Milk, 8 oz. (236 c.c.).
1.00 P. M.—Lunch or dinner, a full meal, without permitting any choice. This should be varied and copious, but without wine.
4.00 P. M.—Milk, 8 oz. (236 c.c.).
7.00 P. M.—Dinner or supper, which should be equally copious.
9.00 P. M.—Milk, 8 oz. (236 c.c.).

Dubois states that the effect of this treatment varies according to the case. Those who have not been copious eaters, and who are extremely emaciated, may show some gain in weight during the first week. Patients, however, who have been large eaters usually lose some weight. At the end of the second week both types begin to show a decided increase in weight, varying from 2 to 10 pounds. This, in itself, often brings with it a feeling of euphoria.

Massage.—In all patients undergoing full rest treatment, massage is a desirable accessory measure. In milder cases it is often a helpful adjuvant. Massage may be general or local, and may be used so as to produce either soothing or stimulating effects. In the neuroses it is customary to employ general massage, and to use at first only those movements that have a sedative influence.

The effects of massage are, in its milder application, distinctly soothing upon the central nervous system; at the same time massage stimulates the flow of blood and lymph, furnishes gentle exercise to the muscles, stimulates cutaneous activity, causes an increase in the number of red blood corpuscles, and produces a decided psychical reaction. The choice of a masseur or masseuse is a matter of importance. The operator should be refined, modest, gentle, and of pleasing appearance, and he (or she) should possess some knowledge of the neurasthenic mentality. In case the choice has not been well made, it is wise to change; for a psychical effect, when it is not helpful, may be detrimental. Local massage, because of its tendency to fix the patient's mind upon a particular region, should be cautiously prescribed, if at all. General massage may in the beginning aggravate the symptoms somewhat and disturb sleep; but this effect is only temporary, as a rule, and should not lead one to discontinue it. When the neurasthenic state is associated with organic disease, certain parts of the body may have to be avoided by the masseur. Only stroking and kneading movements should be used at first for a short period; gradually the time may be increased to one hour, and in a few

cases massage may be given twice daily for an hour at a time. Most patients get along well with massage three times a week. After the patient gains weight, the more vigorous methods may be used, and stimulating gymnastics or Swedish movements may be added.

Eleven o'clock in the morning or 4 o'clock in the afternoon are convenient hours for massage for most patients. If insomnia be a prominent symptom, massage, a half hour, or an hour, before bedtime sometimes alleviates it. Some patients are, however, made more wakeful by late massage. The attentions of a good hair-dresser are often helpful. Sometimes the application of a vibrator to the scalp, face, and neck will be found to be a useful adjuvant in treatment.

Soothing Hydrotherapy.—This is one of the most valuable aids in the general and symptomatic treatment of neurasthenic states. The effects of water may be sedative or stimulating, depending largely upon temperature, duration of treatment, and method of application. Aside from their physical effects, hydriatic measures carry with them certain suggestive effects upon the psyche. In general, warm (92° to 98° F.—33.3° to 36.7° C.), tepid (85° to 92° F.—29.4° to 33.3° C.), and cool (60° to 70° F.—15.6° to 21.1° C.) applications have a soothing effect; while hot (98° to 106° F.—36.7° to 41.1° C.) and cold measures 40° to 65° F.—4.4° to 18.3° C.) are stimulating. The choice of procedure will depend, then, upon the reactive powers of the patient and upon the special effect desired. Temperatures below 85° F. (29.4° C.) when applied to the general body surface cause: (1) vasoconstriction in the skin; (2) stimulation of the heat-regulating center, with subsequent peripheral dilatation; and (3) depression of the vasomotor center.

In the treatment of neurasthenic states, the mildest hydrotherapeutic measures are, as a rule, the best. Potter, Ziemssen, Bouveret, Buckley, and others warn against the use of violent stimuli, such as very cold or prolonged applications, or too vigorous friction; they may produce marked depression or actual shock. Godlewski has found the milder treatment especially efficacious in those with arterial hypertension, in whom there has followed a decided fall in blood-pressure; he reserves the stimulating measures for the patients with hypotension. Routine observation of the blood-pressure before and after the use of hydrotherapy may be helpful as guides to treatment.

Among the soothing hydrotherapeutic procedures a few may be especially mentioned.

Tepid or Warm Sponge Bath.—The patient, in bed, is gently sponged from head to foot with fresh water, at a temperature of 95° F. (35° C.). The body is dried without much friction, or the sponging may be followed by an alcohol rub and rest. The sponge bath is best given in the morning.

Full Tub Bath.—This may be given tepid or warm, the duration varying according to the temperature used. If below 90° F. (32.2° C.) it

should not last longer than five or ten minutes, and should be followed by gentle friction, a warm dressing gown being provided. Shivering should shorten the stay in the tub. A warmer bath is more soothing, and may be given either in the morning or just before retiring. The latter hour is chosen when a soporific effect is desired, the bath lasting from twenty to thirty minutes. For patients upon partial rest treatment who complain of a tired feeling upon waking, a hot bath, 100° F. (37.8° C.), followed by a cool spray or sponge, is often very beneficial on rising.

Wet Pack.—This is one of the most valuable of the hydrotherapeutic measures. Its effects are both stimulating and sedative; the stimulation is only temporary and is followed in a few minutes by its soothing effects. A rubber sheet, covered by a double dry blanket, is laid upon the bed. A sheet soaked in water at 85° F. (29.4° C.) is wrung as dry as possible and spread smoothly over the blanket. The patient, disrobed, is placed upon this, and the sheet is snugly wrapped about the body, between the legs and about the arms, so as to avoid air spaces, which are apt to cause chilliness and discomfort. The blanket is then wrapped about the body in a similar manner, and two additional blankets are thrown over the patient. A hot-water bottle is placed at the feet, and a wet towel, wrung out of water at 95° F. (35° C.) placed upon the forehead. The pack should last twenty minutes or half an hour. Upon removal from the pack the nurse rubs dry with towels, or gives an alcohol rub. Occasionally friction is employed during the pack. Entrance into and exit from the wet sheet should be rapid, care being taken to avoid chilling. Many patients will at first object to a wet pack, but its disagreeable features, and the patient's aversion to it, are soon overcome, unless it be faultily given. The wet pack may be given daily for as long as two or three months, in which case the temperature may be reduced a degree or so every day, until 60° F. (15.6° C.) is reached. Used in the evening, it is a valuable means of overcoming insomnia.

Drip Sheet.—With the patient standing in a bath tub containing just enough hot water (100° F.—37.8° C.) to cover the ankles, a dripping wet sheet taken from water at 80° F. (26.7° C.) is thrown about the body and brisk friction with the hand over the sheet is commenced. The attendant may rub the back, while the patient rubs the chest and abdomen himself. This is continued about one minute. A warm dry sheet is next thrown about the patient and friction is applied, or he may be briskly rubbed with warm towels. A short rest after the treatment is advisable. The temperature to which the patient responds most readily can soon be ascertained. The drip sheet may be given in the morning or evening. It, too, is useful in combating insomnia.

Douches.—These may be local or general, and mild or vigorous, de-

pending upon the force with which they are given. For sedative purposes the warm, gentle douche, of short duration, is used. A variety of applications have been found serviceable. Potter recommends the Scotch douche, or a warm douche, to the lower part of the body. Bouveret has had good results from general douching, beginning with a temperature of 76° F. (24.4° C.), and gradually reducing to 60° F. (15.6° C.). Applications to the head and neck, however, are avoided. Godlewski finds the hot douche (104° F.—40° C.), given either as a shower or jet of moderate force, very effective as a sedative. After the douche friction is applied, and a warm bathrobe put on. In the spinal type (myelasthenia) good results are often obtained by having the patient sit on the edge of a bath tub, while the attendant sponges the back, from shoulders to tip of spine, with hot water (105° F.—40.6° C.) for three minutes; this is followed first by an affusion of cold water (75° F. —23.7° C.), and then by a dry rub with a hot towel. Wood recommends a "submerged douche" as an excellent sedative. For this the patient reclines in a bath at a temperature of 93° F. (33.7° C.), and a jet of hot water at 104° F. (40° C.) from a "rose" or nozzle is directed under water upon various parts of the body. Here the psychic effect is doubtless an important feature.

Any of these procedures may be given at home, in a general hospital, or in an especially equipped institution. The sponge bath, full bath, and wet pack may, in milder cases, where removal from home is impracticable, be successfully employed at home without the aid of a trained attendant. In general, however, better results are obtained when hydrotherapy is administered in a regularly equipped sanitarium for the treatment of nervous patients. But, even in a sanitarium, no elaborate hydrotherapeutic establishment is necessary. For further details on the application of hydrotherapy to nervous cases the work of Hinsdale, or that of Kellogg, may be consulted.

We would especially warn against being "overbusy" in hydrotherapeutic applications. We have known patients to be seriously fatigued by the overzeal of ardent hydrotherapeutists.

Sympathy and Encouragement.—The physician is fortunate who can apportion to each psychoneurotic patient the kind of sympathy he should have, in right amount. To discriminate wisely and to administer sympathy judiciously are often difficult matters. A thorough recognition of the psychical element in neurasthenic and psychasthenic states, and an understanding of the reality of mental suffering, are essential. One must try to put oneself in the patient's place. It must never be imagined that it will suffice to say to him, "There is nothing wrong with you. Your troubles are imaginary; go to work and forget them." When one can do so, it is better to say: "I have examined you thoroughly, and can find no serious organic disease anywhere. Your nervous symptoms have been

making you very miserable, but you can, I believe, be relieved." On medical visits, should numerous nervous symptoms be reported, it is not always well to turn a deaf ear. One has to listen to them patiently, and not appear to be in a hurry. Usually it is a relief to the patient to learn that his symptoms are not at all uncommon in nervous cases, and that, though they cause discomfort, they are not dangerous in themselves. The patient is taught to bear them as well as he can until they pass, and is urged to ignore them as far as possible. The physician who gives a local treatment for every local symptom will, as a rule, fail to help his patient.

Encouragement must be systematically given, particularly in the cases under prolonged full rest treatment. Its necessity as a therapeutic measure is well expressed in the words of Dr. Clifford Allbutt, who says that "the patient who can lift his eyes to the future will recover; he whose thoughts writhe in the past is on the broad road to lunacy." Encouragement brings needed calm, and helps to give poise to apprehensive neurotics. They have been ill, perhaps, for years; they have tried many "cures" and consulted numerous physicians without relief, until, finally, their confidence in themselves, as well as in the medical profession, may have been severely shaken; often they have almost resigned themselves to chronic invalidism.[3] If one can honestly hold out to these discouraged ones the hope of relief, if he be able to relate instances of cure in similar cases, if he take care to minimize temporary setbacks and to dwell on every sign of improvement, the patients "gather up their loins" and go forward. The physician does well to trust his patient, to make him feel that he has confidence in him. Much is gained by assuring a patient that he will often find that he can really do the thing he fears he cannot do. The physician may create a desire in the patient to fulfill expectation in the way of improvement; when this can be done the benefit is often speedily attained and surprising.

The psychotherapy for these patients should be divided into two parts: (1) that directed toward the underlying mental state of the patients; and (2) that directed toward the functional manifestations of which the patients complain. In treating the underlying mental state, the physician will endeavor to restore the integrity of the personality chiefly by encouraging *avowal* and in developing the *conviction* that cure is possible and will do all he can to *free the patient* from the emotional preoccupations that have been responsible for his state. In treating the functional manifestations, the psychotherapeutist will *examine, interpret, reassure, teach to ignore, teach to forget,* and, in general, *reëducate* to normal life.

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[3] In this connection, the reader is referred to an article by Esther L. Richards on the "invalid reaction" in the *Bulletin of the Johns Hopkins Hospital* and to a clinic on "A Psychoneurotic Presenting a Chronic Invalid Reaction" by L. F. Barker in his *Tuesday Clinics at the Johns Hopkins Hospital.*

Exertion of the Central Nervous System

Gradual Return to Bodily Exercise.—Toward the close of the protective régime, stimulating and tonic measures are gradually begun. More vigorous and prolonged massage, including deep kneading and tapotement, may be used to advantage, and Swedish movements given. Active movements against gradually increased resistance may be prescribed. The patient should, after a rest cure, be allowed to get up only gradually. Where rest has been complete one begins by allowing him to sit up in bed or in a comfortable chair, preferably in the open air, for a short time each day. At first he should be up only in the mornings; later, also in the afternoons. The time up is gradually increased, until finally most of the day is spent out of bed. By this time, too, the patient has been allowed to walk a little, and the walking may be slowly increased in amount until four or five miles per day are covered. Calisthenic movements may be taken up, preferably keeping time with lively music (victrola), and later more complicated and more energetic gymnastics. It is well to furnish the patient with a pamphlet giving full directions for the movements, or, better still, to place him at first under an instructor. The exercises described in R. F. McKenzie's *Exercise in Education and Medicine,* in J. F. Müller's *My System,* in Dickson and Diveley's *Exercises,* and those in Sanford Bennett's *Old Age; Its Cause and Prevention* may be found useful in planning a régime. A regular time-table for the twenty-four hours should be made out, reserving an hour especially for the exercises; as a rule, a morning hour is best. Part of the afternoon may be spent in walking, playing croquet, driving, riding, or other out-of-door occupation. By such means the body may be gradually developed to a degree of physical efficiency compatible with the normal activity of the person. Overstimulating and fatiguing exercises are, at all times, to be avoided. The same individual and discriminating attention is needed here as in the selection of protective measures.

Stimulating Hydrotherapy.—As mentioned above, applications of water at higher and lower temperatures are more stimulating than tepid water; many of the "soothing hydrotherapeutic" procedures may be advantageously used for stimulation by altering the temperature.

A cold shower bath of thirty seconds' duration is bracing, but the temperature should not be lower than 60° F. (15.6° C.). It is best given after the morning exercise, and should be followed by brisk rubbing, and, perhaps, by a short walk. Some prefer to have the bath precede the exercise, in which case it may be given in the afternoon, just before the walk. A cool sponge (60° F.—15.6° C.) with friction has a similar effect; it is most conveniently given in a tub containing very little water. Thorough rubbing with warm dry towels follows, after which the patient

takes a short rest in bed. The wet "drip sheet" is also efficacious; it is given for only one or two minutes, beginning at 78° F. (25.6° C.) and gradually reducing the temperature to 60° F. (15.6° C.) or even lower.

Hot or cold douches and nozzle or jet sprays may also be employed, if given cautiously and with suitable equipment. The cold douche may be administered at a temperature as low as 50° F. (10° C.); it should last only seven or eight seconds, and should not be applied to the head and neck. After the douche the patient is removed to a warm room where active friction is applied; afterward, a short walk or mild exercise is advisable. The Scotch douche—alternate hot and cold stream—with temperatures ranging from 50° F. (10° C.) to 105° F. (40.6° C.), given with considerable force, is very stimulating. The cold application, however, should not last longer than ten or fifteen seconds.

Many of the methods employed in exclusively hydropathic institutions are too exhausting for neuropaths. The mistake is often made of subjecting nervous patients to too full a program of "treatments."

Stimulating Psychotherapy.—Rest, sympathy, and encouragement during the protective period have paved the way for more active and stimulating measures during the treatment by exertion. The patient should gradually be led back to an independent existence. For medical direction a courageous self-direction must be substituted. Psychotherapy in general, and stimulating means in particular, are especially suited to the management of the psychasthenic states with their doubts, fears, obsessions, and conditions of anxiety. Every effort should be made to establish self-confidence, independence, and a stoical attitude. Each patient should be studied for himself and, when possible, induced to ride some hobby. Weir Mitchell aptly pointed out a difficulty in his *Characteristics*—the inability of the patient to "saddle, bridle, and mount his hobby." The social consciousness may be awakened, perhaps, the patient being encouraged gradually to relate himself again to others. The will must be trained gradually to the performance of the acts that through lack of initiative, have been neglected. Tasks of gradually increasing difficulty may be assigned, until finally the self-confidence and reassurance essential to independent activity are engendered. If the patient be intellectually inclined, we may prescribe some scientific or literary work, suited to his capacity; thus abstracting, the study of a foreign language, essay-writing, botanizing, etc., are often helpful. Some may be ambitious to become productive workers, but they lack initiative, or do not know *how* to begin. Here is the opportunity for medical pedagogy. Some physicians have the knack of leading their patients into such work; others, it must be confessed, are unsuited for this kind of psychotherapy.[4] Among the smaller books that may be put into the hands of patients of varying

[4] Austin F. Riggs, of Stockbridge, Massachusetts, is a notable example of a successful psychotherapeutic instructor.

intellects may be mentioned: *Rational Living,* by King; *Why Worry,* by Walton; *Self-Help for Nervous Women,* by John K. Mitchell; *The Human Machine,* by Arnold Bennett; *The Influence of the Mind on the Body,* by Dubois; *How to Do It,* by E. E. Hale; *Happiness,* by Karl Hilty; *Cardinal Virtues,* by W. D. Hyde; *Ethics of the Dust,* by John Ruskin; *Courage and Youth,* by Charles Wagner; *Map of Life,* by W. E. H. Lecky, and *Social Rights and Duties,* by Sir Leslie Stephen. Emerson's essays, especially his "Self-Reliance and Compensation," will help many toward needed independence and optimism. Even the uneducated sometimes find the little books by Annie Payson Call, *Power through Repose, The Freedom of Life, Everyday Living,* helpful. The more highly developed and trained cerebral cortex will enjoy Paulsen's *Ethics* (Thilly's translation) and the classics: Plato, Aristotle, Marcus Aurelius, and Epictetus. Each physician will easily add a number of other books to this list.

The young physician desirous of training himself in psychotherapy will find much that is valuable in Weir Mitchell's writings, in Camus and Pagniez's *Isolement et Psychotherapie,* in P. Dubois's *Psychic Treatment of Nervous Disorders,* in Déjerine and Gauckler's *Psychoneuroses and Their Treatment by Psychotherapy,* in W. R. Dunton's *Occupation Therapy,* in R. C. Cabot's *What Men Live By,* in P. E. Levy's *Rational Education of the Will,* in the books on *Mental Hygiene* by W. A. White and by Ira S. Wile, in A. Adler's *Neurotic Constitution,* in P. Janet's *Les Obsessions et la Psychasthénie,* in H. Oppenheim's *Letters on Psychotherapeutics,* in A. Gross's *Allgemeine Therapie der Psychosen,* in E. Hitschmann's *Freud's Theories of the Neuroses,* in Jung's *Psychology of the Unconscious,* in A. Brill's *Psychoanalysis; Its Theories and Practical Application,* in P. Bousfield's *Elements of Practical Psychoanalysis,* in S. Freud's *General Introduction to Psychoanalysis,* in L. E. Bisch's *Your Inner Self,* in S. Paton's *Signs of Sanity,* and in McDougall's *Social Psychology.*

Return to Physical, Mental, and Social Activity.—A neurotic patient, leaving a hospital or sanitarium, or on ceasing to be supervised at home, sometimes resumes the activities of life too hastily. How often, shortly after apparent recovery, patients are compelled to turn again toward medical aid because their symptoms have come back. Such patients are likely to be very discouraged, and to be disgusted with hospitals and with doctors.

To avoid relapses, proper "after care" is essential; the physician should make this clear to his patients, and it is usually well (1) to furnish a written schedule regulating the amount of work to be undertaken, and giving specific directions for the daily routine; and (2) to maintain supervision by interviews at gradually lengthening intervals until health is firmly reëstablished and the patient has learned "how to live."

Work and Occupation Cures.—For many years systematic occupational methods were confined almost entirely to the institutional care of the insane, where it was found that much of the manual and skilled labor necessary in the management of the institution could be performed by the "paroled" inmates, with considerable reduction in the cost of maintenance. General improvement in the physical and mental health of patients thus employed soon became apparent, and gradually work and occupation became adopted as valuable therapeutic agents in many of the more progressive institutions. Similar methods have also been found of service in the treatment of epileptics and the feeble-minded.

We owe the first systematic employment of these measures in the milder neurotic states to Moebius, of Leipzig, whose work-cure schedule has been widely imitated and adopted. Work and occupation cures for neurasthenic and psychasthenic states are now everywhere gaining adherents; they are doubtless destined to supplement, in an important way, the older methods of treatment by complete rest and isolation. In depressed, melancholic, hypochondriac, psychasthenic, and some neurasthenic states systematic occupation, in conjunction with partial rest treatment, is often most useful in therapy.

Work may be mental or physical, manual or skilled, productive or non-productive. As A. S. Thayer, writing of work-cure, emphasizes, the work should be interesting and pleasurable; it should make sufficient demand upon the patient's attention; the patient must learn to "look out, not in." Otto Veraguth has made the following convenient divisions of occupational methods: (1) work in which muscular energy of a productive character is expended, including cabinet making, gardening, and the various mechanical arts; (2) intellectual work in art, literature, or science; (3) work expending muscular energy, but of a non-productive character, including the various outdoor sports; and (4) varied employments, including drawing, clay modeling, and wood carving.

Following Moebius's publication in 1897, occupational therapy received a strong impetus in Germany, where it has since reached a high degree of efficiency. Since 1906 definite steps toward adopting it in this country have been taken; its usefulness has become more widely recognized, and work rooms, or outdoor occupations of some sort, have been established in connection with many of the privately endowed sanitariums. The work-cure is not yet so well developed here as abroad; there is still dispute as to benefits, the indications for it, the best method of administration.

In all cases of neurasthenia and psychasthenia, as health is approached, a stage is reached in which occupation is essential. It may be desirable at the very beginning of treatment in some cases; in other instances it is in place only after rest for a period. In many of the milder cases H. J. Hall, of Massachusetts, prescribes rest for only one or two days, or per-

haps a week; then, without warning, he may require the patient to perform some task. The daily program is gradually changed so that rest is diminished and work increased; in the end the full "work shop" or "occupational" course is in full swing. This author makes little use of massage, hydrotherapy, or electricity, and advocates manual work in preference to any other form of occupation; it is "objective and wholesome, and trains to accuracy and precision of movement." He places his patients in the care of a trained instructor in pottery and fabric weaving by hand, and encourages them to produce articles of sufficient merit to have a market value; if sold, the proceeds are credited to the patient's account. Wilson, of Philadelphia, has had some success by combined forced feeding with work carried to the point of fatigue. He advises that the patients be fed well, but that they be required to burn up the fuel by active exercise in the open air. Most of his cases were treated, not in sanitariums, but in office practice; his patients were directed to follow a scientific schedule, in which their entire time was occupied every day for a period of six months. The mornings and evenings were spent in active work until fatigue symptoms appeared, after which rest was allowed.

Work exerts a strong psychical effect, often just as beneficial as the physical results. Mechanical labor, in general, is used for its fatiguing effects and associated metabolic changes, whereas skilled labor has a more distinct psychical effect by developing attention, concentration, and confidence. The psychical effect is also greatly stimulated by appealing to the social consciousness; J. J. Putnam has pointed this out in connection with the coöperative occupational methods that have been introduced to some extent in the out-patient department of the Massachusetts General Hospital. The patients are encouraged "to meet regularly under strict supervision; to compare notes as to their success in carrying out modes of treatment that have been prescribed for them, and to gain interest, information, and enthusiasm for new efforts." The social consciousness, however, is more distinctly stimulated by institutional régime, where those who are nervously exhausted may have their new life suited to their tastes and capacities, and be taught the value of systematization and thoroughness in the performance of definitely assigned work. The progress of their co-workers, moderate competition, closer social relations, and the satisfaction arising from useful activity are some of the many advantages to be derived from associative productive occupation.

These principles have been largely adopted in Germany, where many well-equipped "work sanitariums" are to be found in which the proper applications of rest and occupation are made according to the requirements established by Moebius. All false and harmful activity is excluded; good work is done under the direction of an able and sensible instructor. These hospitals, or *Nervenheilstätte,* are in reality technical and academic

schools, well-appointed and furnishing instruction by occupation in all departments of human activity. The patients are taught how to live, and they acquire, in addition, a certain degree of proficiency in a selected trade, or in a clerical or agricultural pursuit. Colony sanitariums, somewhat similar in plan and administration to those used in the treatment of tuberculosis, have also been established for the nervous unfit. Whether or not compulsory occupation should be enforced in these institutes for neurasthenics is still a matter of dispute. Some maintain that the neurotic person should not be driven to any task, or forced to act contrary to his natural inclination. But any serious treatment of neurasthenic states makes demands upon the patient that are not altogether to his liking. How frequently are prescriptions of rest, isolation, and hydrotherapy objected to at first, the patient stating emphatically that such treatment cannot be endured. Once accepted by the patient, however, it is the physician's duty to see that all details of a régime are accurately carried out, regardless of the whims of the patient. In like manner, if a "work-cure" be decided upon, the character of employment being carefully selected, suited to the personal needs, it should be uncompromisingly, though tactfully, carried through.

In America some of the better hospitals and private sanitariums make some use of occupational treatment. The method is gaining in popularity; physicians are recognizing that a large part of their duty in the after-cure of neurasthenic patients consists in providing some form of stimulating and congenial occupation of the body and mind (Jacoby).

Many forms of occupation may be considered. Carpentry and gardening are two types that furnish an excellent combination of mechanical and psychical factors. Carpentry, particularly, is useful because of its variety and on account of the rapidity with which productive results may be obtained, and of the interest that it stimulates. For some, bookbinding, scrollsawing, pyrography, drawing, stenography, modeling, photography, or clerical work may be suggested. Grohmann characterizes basket-making and analogous occupations as "stupid." More distinctly intellectual employment may be had in art, music, literature, or science, and almost any well-chosen country place will provide opportunities for the study of ornithology, geology, or astronomy.

Nurses in charge of nervous patients would do well to familiarize themselves with the contents of W. R. Dunton's excellent manual entitled *Occupation Therapy,* and of Hall and Buck's volume *The Work of Our Hands.* A journal, the *Archives of Occupational Therapy,* began publication in 1922. The first number contains an interesting article on "The Philosophy of Occupation Therapy" by the psychiatrist, Dr. Adolf Meyer.

Supplementary Therapeutic Procedures—*Travel.*—If by travel were meant continuous peregrinations, it would rarely be permitted in the

treatment of neurasthenia. The asthenic patient is fatigued and exasperated by the worry, excitement, and constant solicitude in the bustle and commotion of modern methods of transportation. It was formerly believed that the constant change of scenery, the absence from home and business, and the novelty of unfamiliar habits and customs incident to a prolonged voyage to a foreign country would serve to displace many of the cerebral symptoms in the overworked, wornout man of affairs; hence, a trip abroad was unhesitatingly advised. Fifty years ago, when time was less valuable and travel was slow and not so luxurious, some benefit may have been derived from an ocean voyage or an inland journey with prescribed intervals of rest. Nowadays, as Buckley emphasizes, it may be wise to choose a slow steamer, and to urge avoidance of fashionable resorts. Bouveret prefers short seacoast voyages near home to an extended tour; a few weeks' travel in the mountains in the summer, or a trip along the warmer seacoast in the winter. The "cerebral" type of patient, he thinks, fares better than the "spinal" type. Godlewski is very emphatic in his disapproval of travel for the asthenic type of patient, although he occasionally prescribes a short, carefully selected voyage for the healthy, robust, full-blooded patient with increased arterial tension. As he points out, constantly changing scenery and excitement are especially harmful to those in whom asthenopia is a prominent symptom.

Thus, while the advice to "go abroad" or to "discontinue business and make an extended tour of the country" is often harmful, still there can be no doubt that limited travel is worthy of some consideration in treatment in selected cases. We should be quite certain that the patient is physically strong enough to undertake the journey, and see to it that the itinerary is wisely arranged, as regards rest, companionship, and quiet.

Climate.—For those whose physical condition and finances will permit them to make an extended journey, the selection of a suitable health resort may be a matter of importance; if left entirely to the patient, harm often results. Keeping in mind the patient's idiosyncrasies, the principal features to be considered in selecting an appropriate resort are altitude, temperature, humidity, purity of the air, and the amount of sunshine. Repeated gray, somber, twilight days are, as a rule, depressing; while bright, sunny, moderately cool days are stimulating and exhilarating.

Some climates (for example, seaside) have a sedative, others (for example, mountains) a stimulating, effect. Three principal regions may be considered when we make our selection: (1) the seashore, (2) the inland sheltered resorts, and (3) the mountainous regions.

In general, as Neville Wood has emphasized, the neurasthenic should have the same climatic conditions as the aged; that is, an equable, moderate temperature in a protected locality of medium altitude. Extremes of temperature, strong winds, great humidity, and high altitude, are to be avoided in all cases. The character and appointments, as well as the cli-

matic conditions, of a resort should also be considered. The attendance and cuisine should be good, and the surrounding scenery attractive and easily accessible. The place should afford moderate entertainment and diversion, but the more fashionable resorts, where bridge, dancing, and excitement prevail, are to be avoided.

The Seacoast.—Opinion appears to be quite generally opposed to a sojourn directly along the sea border, where the climatic conditions are especially debilitating for those that are troubled with exhaustion, hypersensitiveness, depression, or insomnia. Nervous patients often fare much better a few miles inland away from the roar and tumult of the sea.

Mountain Resorts.—Allbutt asserts that a mountain residence in a dry, sunny country comes next in helpfulness to the Weir Mitchell treatment. Ziemssen, however, thought that the importance of high altitudes had been overestimated. If a bracing, exhilarating climate be desired, the more elevated areas may be sought. Too high an altitude may be distinctly deleterious; in sending a patient to the mountains he should not be permitted to go higher than 1,500 meters (4,920 feet). He should also be cautioned not to take too vigorous exercise, particularly if arteriosclerosis coexist. Eichhorst has shown that exercise in the higher altitudes aggravates most of the neurotic symptoms and is decidedly harmful. If the first week or two be spent in repose, the patient becomes, to some extent, acclimated, and may later enjoy a more active outdoor life. The advice of Godlewski may be kept in mind that "if, after fifteen days, tachycardia, insomnia, and restlessness persist, the altitude is too great or the patient is taking too active exercise." On sending a patient into the mountains it is well to advise a gradual ascent. Thus, for example, the early spring may be spent in some resort with an altitude of 500 meters (1,640 feet); later in the summer a height of 1,500 meters (4,920 feet) may do no harm.

The American and Canadian Rockies and the Appalachian ranges of the Eastern United States supply us with a liberal selection of mountain resorts. The climates of Switzerland and the Bavarian highlands offer many excellent resorts, varying in altitude from 500 to 1,800 meters (1,640 to 5,000 feet), which are suitable for neurotic patients.

Balneotherapy and Spa Treatment.—The physical effects derived from the use of baths and mineral waters are so inextricably mingled with the climatic conditions of the locality in which they are given that it is difficult to estimate their value. Winternitz was probably the first to establish the fact that baths, in general, have a primary action upon the nervous system; since then numerous attempts have been made to increase the efficiency of the baths by the addition of various chemical substances. The natural waters are believed to be more efficient than the artificially prepared baths; this may depend upon radio-activity. Among the more popular baths containing chemical substances are those holding the heavy

metals, salts, or gaseous substances in solution. The carbon dioxid bath has been widely used in many conditions, and has enjoyed some reputation in the treatment of neurotic states. It acts locally upon the nerve endings and the blood-vessels; tingling sensations and a sense of general warmth are produced. In giving "subthermal" baths, much lower temperatures may be employed if carbon dioxid be added to the bath. Bran, peat, and mud baths are also largely used. In prescribing balneological or spa treatment for a neurasthenic, a great deal more depends upon the topographical, climatic, and social conditions at the resort, and also upon the medical experience and the personality of its supervisor, than upon the chemical constituents of the waters.

Drugs.—Pharmacological treatment of the neurotic states has varied from extreme polypharmacy to nihilism. That there is no drug-specific for the treatment of a general neurosis is a well-established fact. The most that can be expected from the use of drugs is their suggestive influence, the alleviation of some temporary condition, or their action as tonics or sedatives. Even a hurried review of the literature upon the drug treatment of neurasthenia reveals an agreement in opinion on three points: (1) treatment by drugs has a place, but a subsidiary one; (2) bromin or its salts or arsenic are often useful; and (3) the use of strychnin, especially in large doses, is to be condemned. It would be confusing and of little advantage to discuss, or even tabulate, all the medical substances that have been employed in the treatment of nervous states. The fact that so many drugs have been suggested is sufficient proof of their inefficiency. Some form of drug treatment may sometimes though rarely, in our opinion, be valuable for its psychic effect. But the psychical effect of drug treatment may be harmful if it tends to fix the patient's mind upon the condition we wish to remedy; this is especially true of external medication (ointments, plasters, blisters, setons, etc.).

Sedatives.—In cases with marked cerebral irritability, a brief course of bromid therapy is sometimes helpful. The bromids may be combined with tincture of valerian or sumbul. Bouveret uses the salts of bromin for a longer period and in much larger doses than are usually prescribed. He gives from 60 to 90 gr. (4 to 6 gm.) in twenty-four hours for a period of several months. Ziemssen also used them in doses of 30 or 60 gr. (2 to 4 gm.) given several times daily; he especially recommended the lithium salt. For patients with decided phobias he advised that a mixture of sodium, potassium, ammonium, and lithium bromids be carried in the pocket and a dose taken whenever the "dread" appears. Dana gives bromids in 60-gr. (4-gm.) doses three times daily, until the symptoms of bromism appear, and states that they may be given for longer periods if digitalis, cod-liver oil, and iron be taken at the same time.

It has been our custom to administer the bromids in smaller doses (15 gr.—1.0 gm.), three times daily, and for brief periods only. They should

be given after meals, and they act more quickly if given in hot milk or hot water. Some have advised the use of bromids in protracted insomnia, but usually the hypnotic action is tardy, and it occurs only after larger doses, from which secondary depressing effects are prone to follow. In nocturnal restlessness with insomnia, the cautious (temporary) use of the mistura chloralis et potassii bromidi composita of the National Formulary may be found to be helpful.

Valerian and the iron, quinin, and zinc salts of valerianic acid are largely used for their sedative action. The pill of the "three valerianates" recommended by Goodell has become quite popular among general practitioners as a remedy for motor restlessness and irritability. The monobromate of camphor, zinc preparations, and cannabis indica have also enjoyed a certain reputation for their quieting effect.

Tonics.—Iron, arsenic, quinin, nux vomica, atropin, the phosphates, glycerophosphates, and simple bitters are among the drugs commonly employed for their stimulant and alterative action. Many patients appear to be benefited by brief courses of tonic treatment, especially on return to bodily activity. Dr. Weir Mitchell began even earlier. In the third week of rest treatment he sometimes gave cod-liver oil, ½ oz. (14.7 c.c.) after each meal, and, when the full diet was resumed, 1 oz. (29.57 c.c.) of malt extract containing 5 gr. (0.324 gm.) of iron pyrophosphate three times daily. If the patient be anemic, Blaud's pills or iron and strychnin in 1/30-gr. doses may be given after each meal. Larger doses of strychnin, however, are not usually well borne by neurasthenics. Arsenic may be administered in any form, but is more commonly prescribed as arsenious acid in 1/100 to 1/40-gr. (0.00065 to 0.0016-gm.) doses three times daily, after meals; it is believed by some to be useful in gastric and vasomotor disturbances. A course of eight hypodermic injections of sodium cacodylate (0.05 gm. at a dose) is often followed by a marked gain in body weight, since arsenic, like quinin, retards metabolism. When it is inconvenient to administer arsenic hypodermically, one may give an elarson tablet after each meal by mouth for three weeks.

The phosphates and glycerophosphates have been much vaunted; some prefer phosphorus in its natural form or in organic combination with the various articles of diet. In marked vasomotor relaxation ergot, ergotin, suprarenal extract, adrenalin, and sometimes strychnin have been recommended. Nitroglycerin, sodium nitrite, and erythrol tetranitrate have been used in cases with high arterial tension, but simple hygienic-dietetic treatment is, as a rule, far better. A course of injections of vasotonin (0.06 gm. per dose daily for twenty days) has been recommended in the neurasthenic states accompanying beginning arteriosclerosis.

Hypnotics.—Opium preparations are to be strongly condemned, and hypnotics in general are to be avoided if sleep can be procured by any other means. It may be necessary, however, in some cases to use drugs

for a brief period in order to overcome protracted insomnia. Thus, veronal, trional, adalin or sulphonal may be given for a few nights, and the dose gradually decreased until the drug is withdrawn. Veronal should be cautiously given, since it sometimes produces untoward effects. Paraldehyd in doses of 1 to 1½ gm. (15.4 to 24 gr.) has been warmly recommended. Its disagreeable taste may be diminished by the addition of bitter orange syrup. In prescribing hypnotics, it should be remembered that the will power in many neurasthenics is greatly weakened and the establishment of a drug habit is to be guarded against.

Electricity.—The results obtained by the electrical treatment of neurasthenia are subject to two interpretations: some believe that some obscure physical or metabolic change is produced, the nature of which we do not understand; others regard the benefits as chiefly psychic. If many of the properties of electricity are obscure to the medical mind, it is not strange that the lay mind should experience a strong psychic stimulus from electrical treatment. Aside from the mental effect, certain bodily changes may undoubtedly be produced. As a substitute for physical exercise faradization of the muscles may occasionally be employed to advantage. Some effect is also produced upon the cutaneous vessels; a sense of well-being and repose sometimes follows general faradism.

Avoidance of Drugs.—On the whole, we urge that drugs should be avoided in the treatment of psychoneuroses, even as palliative measures. As a rule the use of drugs in these maladies is an abuse of the credulity of the patients. Moreover, drug treatment is here rarely efficacious, aside from the accompanying danger of aggravating the psychoneurosis. The physician who begins to treat the headache of the psychoneurotic with acetanilid, his insomnia with veronal, his indigestion with pepsin, his fleeting pains with aspirin, his asthenia with strychnin, or his constipation with cascara, reveals either his forgetfulness, or his lack of knowledge of the nature of the disorder and its proper therapy. Many neurasthenic patients carry a small drug store about with them, and one of the first duties of the physician who understands the psychotherapy of neurasthenia consists in weaning these patients from their drug habits. Let him who is in doubt in this matter read the very amusing description by Brian Borun Dunne, entitled *Cured! The Seventy Adventures of a Dyspeptic,* and one may even doubt this highly credulous author's interpretation of his final "Cure!"

Sanitarium and Hospital Treatment.—Increasing prevalence of nervousness and the demand for suitable places of retreat have resulted in the establishment of numerous public and private sanitariums for the treatment of nervous and mental diseases. Unfortunately, many of these institutions are conducted in a frankly commercial spirit, without adequate medical supervision, and with too little regard for the needs of the individual patient. In some cases the medical superintendent has had little

or no training in the management of nervous patients, and occupies his position largely because of his administrative ability. New systems and routine are often harmful when applied indiscriminately to all patients admitted to an institution. The intermingling of the purely functional neuroses with the insane, the alcoholic, and the drug habitués in many sanitariums is also to be deprecated.

Undoubtedly the most appropriate surroundings for the treatment of the neurasthenic and of some of the psychasthenic states are to be found in well-equipped sanitariums, and in nursing-homes, devoted exclusively to the purpose. Fortunately there are many institutions of this type to be found both in this country and abroad. The advantages are numerous. The general routine and system prevailing create habits of regularity in daily deportment. Irritating influences are reduced to a minimum; isolation, when indicated, may be more easily enforced; dietetic measures may be more accurately prescribed; personal control of the patient is more easily secured; and many of the more useful hydrotherapeutic measures are to be had only in well-appointed sanitariums. In addition, work and occupational cures of various sorts are more easily prescribed in specialized institutions.

In America there are good sanitariums in different parts of the country. In fact there is scarcely a city of any size that is not within convenient distance of a suitable retreat for nervous patients. In New York (Clifton Springs, Kerhonkson, Watkins' Glen), Connecticut (Cromwell Hall), New Jersey (Galen Hall), Maine (Bethel), Massachusetts (Boston, Marblehead), Maryland (Baltimore), Pennsylvania (Philadelphia), North Carolina (Asheville, Pinehurst), Florida (Palm Beach), California (Santa Barbara), Colorado (Colorado Springs), Texas (San Antonio), Georgia (Atlanta), Indiana, Wisconsin, etc., are to be found excellent resorts for rest cures and the general management of nervous patients; while Massachusetts, Connecticut, and Maine in particular have several institutions in which work and occupation cures are extensively employed.

Hospital Treatment.—The expense and inconvenience associated with the removal of a patient to a distant sanitarium, the fear of an unfamiliar institution and of a strange physician, in part account for the indecision and hesitancy shown when sanitarium treatment is suggested. If this aversion be marked, it may be necessary to choose between treatment at home and in a general hospital. Of the two the latter is, in most cases, to be preferred. The hospital should be agreeably situated, the wards and private rooms should be cheerful, and, as far as possible, free from unpleasant odors; and medical and surgical cases should be cared for in separate departments. The services of a special nurse should be engaged, and the house physician should be especially interested in nervous patients if he is to help in the supervision of the patient.

For those who cannot afford the expense of a private room or the serv-

ices of a special nurse, much improvement may, in selected cases, follow a few weeks' stay in a general public ward. If the patient be hypersensitive and suffer from false pride at the thought of being in a public ward, the treatment will scarcely be of benefit. With the hearty coöperation of the patient, however, much good is often done. Rest and suitable diet can be more easily arranged for; removal from home surroundings is secured; partial isolation can be attained by means of screens. These protective measures may be easily carried out in a general hospital, but some difficulty may be encountered when the time arrives for stimulating and occupational treatment.

The present tendency in hospital treatment is to shorten the period of rest and isolation, sending the patient soon on a vacation, where he may continue a modified rest cure with selected occupational features.

We have found hospital treatment admirably suited to certain patients, and some of our results attained by simple methods are described in the *American Journal of the Medical Sciences* for October, 1906, page 492.

Treatment at Home, in Nursing Homes, and in Country Places.—If we consider the etiology of the psychoneuroses it would seem that home treatment must occupy a minor place in the therapy of these conditions. In all severer cases it is contra-indicated. Occasions arise, however, in which no choice is permitted, and the general practitioner is called upon to direct the management of a case in the face of conditions that would cause the most experienced neurologist to quail. Much can be done, however, even in an unfavorable environment; the results will largely depend upon the physician's supply of common sense, his personal attributes, rational sympathy, and force of character.

The patient should be put to bed in a room by himself. If a trained nurse is not to be had, some member of the family, whose wisdom, tact, and understanding are to be relied upon, should assume the duties of nurse. All other members of the family and visitors are to be excluded from the patient's room. It is often helpful to begin with a brief period of milk diet (Dubois). When full feeding is resumed general light massage may be prescribed in the morning and wet sheet pack in the evening; later on some form of diversion, reading, sewing, games, or physical exercise may be added. As far as possible, all household, domestic, and financial worries are to be excluded. If the patient be the mistress of the house, her duties should be assumed by some one of her choice in whom she has confidence. Women of hypersensitive and morbidly conscientious nature may feel that their enforced idleness is a burden to the family, or that everything must be going wrong because they have ceased to supervise the household. Their entire time is spent in wondering how affairs are being conducted during their seclusion; each day they insist that tomorrow they must resume the activities of life. Such patients do badly

at home; they do better in a hospital or in the home of some friend or relative.

For those who need rest, a change of environment, or the simpler institutional methods, a well-selected nursing home may be all that is required. In England the nursing home has become well recognized as an efficient method of treating the milder neurotic states. The usefulness of this method is gradually becoming recognized in America, and there are few of our larger cities that have not one or more moderate-priced homes for the care of convalescent and neurotic patients. We have not, however, fully learned the need of nursing homes devoted exclusively to the care of the neurasthenic and psychasthenic. Patients in a well-conducted home need not make great demands upon the physician; occasional visits may suffice. It is preferable, however, to have the nursing home so situated that the physician responsible for the patient may find it convenient to maintain his interest in, and general supervision of, the case.

Among the patients who are benefited by a short stay in a well-appointed country home, away from the noise and bustle of city life, may be mentioned the overworked, tired business man—the cerebrasthenic. He may quickly find relief in a quiet rural retreat, with its abundance of good food, fresh air, and repose, combined with the healthful exercise of mind and body that the activities of country life afford.

Symptomatic Treatment

To speak of the symptomatic treatment of a condition of ill health which is itself regarded as a symptomatic disorder carries with it a confession of the inadequacy of our general principles of therapy to meet the demands in all cases. No doubt in time most of the symptoms will yield to the protective measures previously outlined, and to a carefully planned and executed psychotherapy, and we feel that in every case it is better to give them a thorough trial before resorting to symptomatic treatment. Occasionally, however, one or more features of the neurosis may so predominate as to demand special treatment directed to it alone. This is particularly true in cases where our efforts to secure rest are frustrated by persistent insomnia, pain, headache, excessive cardiac irritability, phobias, or anxious states. Fatigability, restlessness, hyperacusis, depression, constipation, anorexia, and sexual abnormalities may also demand especial attention in certain cases. We must treat the patient as a whole, but the mistake most often made is to neglect general psychotherapy and to overemphasize local and special therapeutic measures.

Insomnia.—As a symptom of ill health, in general, insomnia is one of the most common conditions with which the physician has to deal. Its causes, therefore, are far too numerous to permit of general discussion

in this chapter, and we shall confine our remarks entirely to the insomnias associated with neurotic states.

Unfortunately, we are as yet ill-informed regarding the physiology of sleep. Certain facts seem established, namely, the relations of sleep to (1) the needs of the vegetative life of the inner organs, (2) peripheral excitation of the organs of sense, and (3) the excitations of the mental life. Habit certainly has a great deal to do with (1) the feeling of the need of sleep and the origin of the idea that we should go to sleep at a given time, and (2) the duration of sleep and the reawakening at a given hour. People vary in their methods of going to sleep and in their methods of awaking. Some go to sleep at once, the moment their heads rest on the pillow; others read themselves to sleep, or go gradually to sleep after counting sheep going over a stile. Some at the moment of awaking are wide-awake; others awake gradually, not becoming wide-awake for some little time (minutes or hours), or until after a cold shower and a rub.

Sleeplessness in nervous people may be of two kinds: First, there is that met with in the restless, irritable person of "high tension" who, through an uncontrolled desire to get everything possible out of life, remains up past the normal retiring hour and finds that upon going to bed he cannot sleep. He seeks sleep, and is provoked because it eludes him despite his assumption of various postures. The entire activities of the day then begin to pass, in tormenting succession, through his mind, and the consciousness of dragging time becomes intolerable. He hears every tick of the clock; the rustle of the wind annoys him; the slightest external sound yields a perception out of all proportion to the stimulus. The second type of insomnia may be called "ill-sustained sleep," "ephemeral sleep," or "automatic wakefulness." The patient usually has no difficulty in going to sleep, but may awaken once or twice during the night, and, in some cases, at the same hour each night. In most cases he awakes in the early morning (matutinal insomnia), when the sleepless interval may vary in duration from a few minutes to several hours. In each of the two types different combinations of disturbing factors may be found requiring appropriate therapeutic adaptations. Whatever type of insomnia be complained of, the physician should first determine that insomnia really exists. One dare not depend entirely upon the patient's statement, for patients often feel that they have scarcely slept at all, when in reality they have had many hours of sleep.

Some of the causes of insomnia in the neurasthenic should especially be kept in mind when attempting to overcome it. Pain of some kind may be the disturbing factor, and, if so, should receive primary attention. In those who have difficulty in going to sleep the cause may lie in some abnormality of the daily routine. Overindulgence in tea, coffee, tobacco; insufficient exercise; dietetic errors; worry; overwork; or the patient's attitude toward sleep—dread of going to bed because of previous sleep-

less nights—any of these may be factors in persistent insomnia. The state of the arterial tension should be kept in mind; disturbing nycturia and cardiac irritability are often associated with arterial hypertension.

Some neurasthenics pass through periods when they actually do not sleep at all—the insomnia is absolute. This is, however, rare. Many patients, though they sleep from six to eight hours, assert that their sleep does not rest them, that they feel more tired in the morning than they did on retiring.

In persistent insomnia, a careful study of the psychological automatism of the patient should be made, for here will be found the thoughts, the emotions, and the preoccupations that either prevent the patient from going to sleep, or account for his untimely reawakening or for the dreams that disturb his sleep. It is here that a full avowal on the part of the patient to his physician may bring the needed liberation. Sometimes an elaborate psychoanalysis may be necessary in order to bring the full avowal. As a help in such psychoanalysis, the physician may study Freud's *Interpretation of Dreams* and Jung's *Psychology of the Unconscious.*

The relief of insomnia may depend upon (1) treatment of conditions associated with the general neurosis, (2) general treatment of the nervous condition itself, or (3) upon specific measures directed toward the symptom itself.

As to the general treatment of insomnia, the measures employed for the general neurosis usually suffice to overcome the insomnia. This consists chiefly in the judicious use of psychotherapy and its adjuvants (isolation, rest, diet). Certain physical details should not be neglected. The sleeping room should be in a quiet part of the dwelling; the bed clothing and general appointments of the room should be comfortable and restful. After the evening meal the patient should not be allowed to engage in exciting games, or in lively conversation, or in stimulating reading. The entire mental and physical life should be arranged in a manner most conducive to repose. As a rule, it is better to have the physician make his visit in the morning rather than in the evening, though a short visit to administer some special treatment or to offer a word of reassurance need do no harm.

We consider it very important to reorganize the life of the patient so as to reëducate him to normal sleep. Thus certain hours of the twenty-four are to be set apart for sleep and to be used for no other purpose. We teach the patient (1) to go to sleep at a certain time, (2) to expect sleep then, (3) to try to banish thought during sleeping hours, (4) to decide to lie quietly (though *not* rigidly immobile!) and rest even though he does not sleep, (5) to try not to care whether he sleeps or not, and (6) to avoid getting up and walking about, or reading, in case sleep does not

come. Usually with mild hydrotherapy, rest, and, in severe cases, isolation, the insomnia gradually yields.

As to the *dietetic treatment of insomnia,* the evening meal should be light, and coffee, tea, and stimulating drinks should be prohibited. A glass of hot milk and a cracker, just before retiring, may be of service in the milder cases. Occasionally a mild alcoholic beverage, such as beer, stout, or malt, may be permitted, but alcohol is in general not to be advised. When the insomnia depends upon nycturia, no liquids should be drunk after the evening meal. If the sleeplessness, however, be independent of genito-urinary disturbances, a cup of hot milk administered upon waking will often secure a speedy return of sleep, and, in time, relieve this type of insomnia. In some cases a glass of milk left at the bedside of the patient, to be taken upon waking, will produce the desired results.

Among the *physical agents* employed in combating insomnia, unquestionably the safest and most generally reliable application is the cold wet sheet pack. It is best given at bedtime for twenty to thirty minutes. Not infrequently patients will fall asleep while in the pack. In case the cold sheet is not well borne, a warm or tepid bath or pack, followed by an alcohol rub, may be tried. A wet towel around the calf of each leg is sometimes efficacious. Some neurologists value electricity highly as a sedative and hypnotic, applying the galvanic current to the head for ten or fifteen minutes, the current flowing from the occiput to the forehead. Vibratory massage may also be of service in the milder cases.

The long list of *sedative and hypnotic drugs* at our disposal in insomnia and the certainty of temporary relief from their administration place a very harmful temptation in the path of both physicians and patient. The drug treatment of insomnia should be a last resort, and even then should be used only as a temporary measure; one should keep constantly in mind the danger of establishing a drug habit, for the neurotic patient is prone to choose the path of least resistance. If, however, other measures have failed, or if the insomnia be so pronounced that its immediate relief is necessary, there may be justification for the use of an hypnotic for a brief period. In some cases this may be all that is necessary to reëstablish normal habits of sleeping. It is usually well not to let the patient know what remedy he is taking, or the amount of it. Veronal, trional, amylene hydrate, and paraldehyd are among the most useful drugs and are least apt to give rise to drug habits. The bromids are of little service in insomnia except in the milder cases; they have to be given in small doses, frequently repeated, for several days before any hypnotic effect can be expected. Morphin and chloral are simply mentioned in order that they may be condemned. Hyoscin, cannabis indica, and monobromate of camphor have been used by some where milder hypnotics have failed. In arterial hypotension tincture of nux vomica, valerianate of

ammonia, and lecithin in conjunction with massage, electricity, and tepid baths have been suggested. In case there is arterial hypertension satisfactory results have sometimes followed the administration of a milk and vegetable diet and the occasional use of theobromin or erythrol tetranitrate (tetranitrol). The latter is given in tablets of ½ to 1 gr. (0.032 to 0.065 gm.) each every three or four hours of the day, or during the night if the patient awakes.

Before resorting to the actual administration of drugs in insomnia one may try placing one dose of the drug within reach of the patient, telling him that if he awakes it may be taken without rising. Often the mere knowledge of having in his possession a remedy for sleeplessness will afford to the patient the assurance necessary to repose.

Headache and Psychalgias.—Pain accompanying the neuroses may vary from localized (or general) cutaneous hypersensitiveness to the most excruciating visceral or cephalalgic crises. A very common symptom is a pain in the head, usually described as situated at the "base of the brain" and of a continuous boring character. Similar pains may be referred to the occiput, vertex, or frontal region. Genuine migraine, or "sick headache," occasionally occurs as an associated condition. Pain, of a paroxysmal nature, occurring in the distribution of the trigeminal nerve, is not uncommon, and may, for a time, make one suspect the existence of true tic douloureux. Rachialgia, coccygodynia, intercostal neuralgia, and mastodynia may be very distressing symptoms.

Such headaches and pains in psychoneurotics are often obstinate symptoms; they yield less easily to general treatment than do most of the other neurasthenic complaints. But, in our opinion, it is upon general measures, and especially upon psychotherapy, that we should mainly depend.

The general tendency of physicians is to try local physical treatment for these functional manifestations. Thus in the various treatises we are told that massage, either general or local, manual or vibratory, gives temporary relief in most cases; that occipital massage kept up for some time is often helpful. Hot and cold compresses to the head and neck, or alternate hot and cold douches to the neck, have also been recommended. Electricity, either the continuous current for five or ten minutes to the head and neck, or the high-frequency current for the same length of time, is very often resorted to. A long list of anodynes and analgesics has been made available. Phenacetin, acetanilid, pyramidon, or aspirin are often prescribed in small doses for brief periods. Caffein citrate, cannabis indica, ergotin, and valerianate of ammonia have also been employed.

In our experience it has been found much more satisfactory to avoid local and drug therapy for headache and psychalgias. We first make sure of his personal hygiene; then we reassure the patient, by telling him that there is no danger from the symptoms, that when he is better the symptoms will disappear, or at any rate be less troublesome, and

teach him to bear stoically what he has to bear in the meantime. It is surprising and most gratifying to see how quickly and permanently the symptoms disappear under this form of therapy in the majority of cases.

Constipation.—"Functional" constipation may be dependent upon one or more of several conditions, among which the more important are: (1) irregularity of habit for the act of defecation; (2) atony of the gastro-intestinal tract; (3) insufficient ingestion of liquids; and (4) an improper diet that does not furnish sufficient residue to promote intestinal peristalsis. With these four conditions in mind certain general measures for the treatment of constipation will readily suggest themselves. The habit of attending to defecation at a definite hour each morning, preferably immediately after breakfast, should be established. A glass or two of water should be taken upon rising, and water should be freely drunk between meals. The diet should include a generous supply of vegetables and fruits. If the intestinal atony be marked, and especially if it be associated with visceroptosis, it may be better to restrict the fluids, prescribe a dry diet, and advise the use of an abdominal binder, 14 to 16 cm. wide, to be worn constantly. The use of purgatives, suppositories, or enemata is not advisable. Abdominal massage and gymnastics of the abdominal muscles may be useful in certain cases (see chapter on Constipation).

Constipation nearly always disappears under an abundant diet and general psychotherapy, especially if local treatments and purgatives of all sorts are taboo. Plain mineral oil may be used as a lubricant without harm and is definitely beneficial to many patients. The bulk of the feces can be increased by administering 1 teaspoonful or more of granular agar after each meal.

Most people who complain of constipation think far too much about the functions of their intestines. Once one has eliminated any organic cause, it is best to give an abundant diet, insist on a regular time to go to stool each day, improve the general mental and emotional state of the patient, and teach him to forget his intestines.

Anorexia and Vomiting.—Anorexia often disappears quickly under the general protective measures; the Dubois milk diet for a few days is especially serviceable here. It may be necessary to encourage the patient to eat even in the absence of appetite. In outspoken anorexia, and especially in severe cases of mental anorexia (anorexia nervosa), rigid isolation is essential. It is rarely, though it may be occasionally, necessary to feed the patient by stomach tube. The patient simply must be fed, whether he has appetite or not. Many failures occur because the physician does not isolate the patient, because he has not the right kind of nurse to aid him, or because he has not learned to persuade the patient or to use his authority. The vomiting of psychoneurotics may be controlled by psychic

treatment (isolation, reassurance, and encouragement in the effort to retain small amounts of nourishment given at frequent intervals).

One of the commonest symptoms met with in the treatment of functional nervous states is the fear of the patients that certain foods that everybody eats cannot be tolerated or digested. The patients often cut off one food after another until they are literally starving themselves in the hope of curing their "indigestion." Such gastrophobic patients may be very easy, or they may be difficult, to manage. If the fear be not too firmly established, a full mixed diet, regardless of choice, may be given at the end of a week of milk diet, and with success. In severe forms, a slower method has to be employed, the patients being gradually reëducated to eat all foods despite their fears. In the worst cases in which there is marked emaciation it is often wise to give a milk diet alone until the normal weight has been reëstablished. Beginning with small quantities of milk every one or two hours for twelve hours each day, the amounts are increased until the patient takes 4 or 5 liters of milk every day. In a few weeks the patient's weight may be normal and the physician may then start in to train the patient to eat all kinds of food. Throughout the whole period, the psychotherapy of the general state of the patient should be given careful attention.

Fatigability and Restlessness.—Fatigue is an early and almost constant symptom; an indication of overexertion or of diminished reserve. In either case rest is essential. Loss of sleep is a common cause of fatigue, so also is the worry and the preoccupation of these patients. Care should be exercised in all cases to distinguish between real and feigned fatigue; in the latter rest may be contra-indicated. On beginning the return to activity with these patients care must be taken to reëducate them to exertion without their realizing it. We keep the attention of the patient fixed upon the amount of rest he is to take each day, rather than upon the amount of the exertion. As regards the latter, we tell the patient not that he must walk so much each day, but that he is not to walk longer than a certain time; in other words, we limit the exertion to a maximum and do not fix a minimum.

Restlessness, on the other hand, is frequently an indication of diminished self-control and may be either the cause or the result of fatigue. Hydrotherapy is, here, often beneficial, although, in the beginning, it may be well to prescribe the bromids or valerianates for a short period, or, in the severer cases, even hyoscin hydrobromid may be given hypodermically. The fluid extract of adonis vernalis (1 to 5 minims—0.062 to 0.30 c.c.) with bromid of soda has been warmly recommended. In our experience, however, it is better to overcome the symptoms without the use of drugs. In the long run, success will be far greater.

Palpitatio Cordis.—Nervous palpitation should be more especially discussed under the heading of the Cardiac Neuroses, but a word or two

may not be out of place in this chapter. Many of the cardiac irregularities of nervous origin are associated with vasomotor instability or gastrointestinal discomfort and are often promptly relieved by treating the general neurosis. There are many cases, however, in which palpitation persists even during complete rest. The symptom is more alarming to the patient than it is dangerous; it is frequently associated with anxious states, phobias, and hypochondriacal conditions. In the milder cases it is well to ignore it, but in the severer cases, and especially where tachycardia persists, the existence of Graves' disease should be suspected. As far as possible conditions that contribute to cardiac irritability should be strictly controlled. Tea, coffee, alcohol, and tobacco are to be prohibited, and if gastric symptoms are present the diet should be light, the food given at frequent intervals, and a daily movement of the bowels secured. Such hydriatic measures as the wet-sheet pack, the tepid bath, a modified carbonated bath, or local cold applications (ice-bag over heart) may be used to advantage. Psychotherapy is the most important factor in the management of these cases. We explain to the patient the nature of his trouble, assure him that he may safely ignore the symptoms, forbid him to count his pulse himself and do all we can to distract his attention and to allay his apprehension; drug treatment is rarely necessary. Cardiac stimulants are to be avoided.

Hyperacusis.—It is customary to regard this symptom as a part of the general cerebral asthenia and hypersensitiveness, although vasomotor disturbances certainly augment it in some instances. A common complaint is "throbbing in the ears" synchronous with the heart beat; the pulsation is at times so annoying that the patient declares it to be impossible to lie upon either side. The symptom is sometimes a sign of slight hyperthyroidism. The condition is aggravated by the reclining posture or by partial occlusion of the external auditory meatus. Hyperacusis, with or without "throbbing," is often an annoying cause of insomnia. Some of these patients sleep with the head supported upon the arm or hand. This observation suggested the adoption of a very simple method which has been of benefit in some cases. The object is to furnish some support for the head and, at the same time, prevent the ear from coming in contact with the pillow. For this purpose an ear pad of absorbent cotton wrapped with gauze, and made in the shape of a circular air cushion, is placed about the auricle. It should be of sufficient width and thickness to offer comfortable support to the head and at the same time leave an air space between the external meatus and the pillow. In one instance we had an ordinary pillow so made that in its center there was a circular opening through its entire thickness, and the patient was directed to sleep with the ear over this little tunnel. By this means persistent insomnia, ascribed to continuous aural pulsations, was relieved, and eventually the auditory hypersensitiveness so improved that it ceased to be a source of discom-

fort and the patient was able to sleep in any normal position. In how far suggestion helped here we cannot say, but we record the observation for what it is worth. In hyperacusis all noises about the patient should, for a time, be reduced to a minimum. Later on the patient must be educated to bear sounds. It is interesting that these patients can often bear easily sounds due to their own activities (brass-pounding) while very intolerant of sounds due to the activities of other people!

Anomalies of Micturition.—Frequent micturition (pollakiuria) is often complained of. Others assert that urination is painful or accompanied by a "queer sensation." In such cases, the urine should be carefully studied and a thorough local examination of the urethra and bladder made to rule out a urethritis, a cystitis, a prostatitis, or a nephropathy. If a genito-urinary specialist is called in consultation in a psychoneurotic case, he should be told in advance of the abnormal mental state of the patient and asked to report not to the patient but to the physician. Undoubtedly there are cases that require local treatment and this should then be instituted. But far more often no local treatment whatever is required and, instead, is distinctly contra-indicated. Every neurologist is familiar with the prostatophobe who has suffered weeks or months of prostatic massage without benefit when his trouble was not in his prostate but in his "head." Such patients need reassurance and a total cessation of local therapy.

Genital Disturbances.—Among male psychoneurotics, disturbances of libido, erection, ejaculation, and orgasm are very common. The physicians at Niagara Falls, at Atlantic City and other resorts of honey-mooners are very familiar with such phenomena in the newly-wed. But also before and even long after marriage, functional disturbances of the genitals are common, and are often very troublesome in management.

In women, too, functional genital maladies are very common, and the physician that treats psychoneurotic cases dare not be blind to them. One of the main causes is the ignorance regarding sex matters with which girls are allowed to grow up and with which young women often enter the married state. One is frequently astounded at the false ideas that prevail. Fear of the physical side of sex and disgust with matters sexual are often systematically cultivated, to the great harm of these persons. Vaginismus, frigidity, or coitus interruptus may be important factors in the exacerbation of nervous states. The physician will get much help from the study of Havelock Ellis's *Psychology of Sex* (in six volumes) and of Déjerine and Gauckler's *Psychoneuroses.*

Depression, Phobias, and Obsessions.—The treatment of these more distinctly psychic abnormalities is discussed under other headings.

PSYCHOTHERAPEUTIC TREATMENT OF NEURASTHENIC AND PSYCHASTHENIC STATES, INCLUDING THE PHOBIAS

Lewellys F. Barker and Trigant Burrow

Psychotherapy, or psychic treatment, is, as the name indicates, the application of mental influences in the alleviation of disease. Psychotherapy may, to a certain extent, properly be applied to the treatment of all diseases; but the conditions in which this form of therapy is most efficacious, and in which it permits of extended application, belong to a class by themselves, the so-called "neuroses" in the narrower sense. Maladies with abnormal nervous and mental symptoms, but distinguished by an absence of an obvious organic lesion in the nervous system, are characterized sometimes as "psychic," in that they are disorders that pertain predominantly to the sphere of the patient's mental reactions, or as "functional," in that their physical basis, if there be one, is so subtle that it is not recognizable by the methods at present at our disposal.

That the abnormal nervous and mental manifestations here considered may have neural processes corresponding to them is, of course, not denied. It is clinically convenient, however, to study, by themselves, the patient's subjective experiences as presented in morbid mental states. There may be, too, a real advantage in studying such states simply from the dynamic side, leaving out of account for the time being the question of the presence or absence of structural changes. In this sense psychic diseases may be considered to be disorders of mental adaptation, and a study of normal psychology may be expected to throw light upon abnormal mental functioning, while the careful analysis of diseased states will in turn give new clews for the understanding of normal mental reactions.

It is important at the outset that we bear in mind the necessary limitation of the sphere of psychotherapy to the province of individual psychology, that is, to the province of the individual's mental reaction to external stimuli.

Dealing, then, as we are, with the reactions and adaptations that represent the response to impressions from without, the factors concerned are, in the widest sense, educational. For on healthy impressions depends the healthy adaptation (or education) of a growing organism. Conversely, also, psychic disorders are often the outcome of a faulty education. For when they are the psychological outgrowth of ideas that are false, unsound, and artificial, because of inculcating a mental bias that is jarring, ill-adapted, and untrue, these morbid conditions are evidence of a failure to surround the developing organism with the proper influences of education. The rational treatment, then, of many psychic disorders is essentially pedagogic, and the psychotherapeutist is, thus, largely an educator.

In a broad sense one of the first concerns of psychotherapy should be prevention. Among its primary duties is that of seeking an efficient prophylaxis against nervous disorders through a fitting propaganda of mental hygiene. Here it must provide for the suitable education of the individual from the moment of his birth, for it is in the interest of preventive psychotherapy to see to it that the proper environment be placed about the developing child. But proper psychic prophylaxis comes straightway into conflict with customs and ideas that are inveterate in the constitution of current society; how, adequately, to provide for the mental hygiene of our people becomes a sociological as well as a medical problem. It is gratifying that the National Committee for Mental Hygiene, founded in New York some years ago, and the various State Societies for Mental Hygiene are recognizing and facing the problem.

Unfortunately, however, it is less the preventive measures of the sociologist than the curative resources of the physician that, at present, interest the psychotherapist. Regrettably enough he is less often called upon to point out the safeguards against dangers to be avoided than to correct harm already done. Already the mind of the patient who comes to him has been imbued with unhealthy tendencies. Already an unsound, illogical point of view has been acquired by him through the long-continued ingestion of an ill-suited mental diet. In other words, the patient has received a wrong education, which has to be offset by a proper one. He may, therefore, have to learn to cast off, as worthless, a whole mass of cherished conceptions, because investigation proves them to be based upon false, unsound premises; he must be taught how to supplant them with others. The process is essentially that of altering the mental attitude of the patient, acquired through the unhealthy impressions he has received, by the substitution of different impressions. It may involve an entire remodeling of the patient's mental laboratory. Such a reconstructive process, the basic principle in the psychic treatment of mental disorders, is called "reëducation."

Of the forms of psychotherapy that may be distinguished on the ground of the particular reëducative resource on which emphasis is laid (1) that employed by Janet, of the Salpetrière, (2) that of Bernheim, of Nancy, (3) that of Dubois, of Berne, (4) that of Freud, of Vienna, and (5) that of Déjerine, of Paris, are among the better known.

The distinctive feature in the therapy of both Janet and Bernheim—sometimes referred to as the Paris and Nancy schools—is the employment of hypnotic suggestion as the principal therapeutic resource. This statement applies chiefly to the treatment of hysteria as far as Janet is concerned, for Janet emphasizes the difficulty or even impossibility of hypnotizing the majority of psychasthenics. Though this Paris school sees in the phenomenon of hypnosis the evidence of a diseased psyche, to be hypnotizable is synonymous, for them, for being hysterical—and, though,

for Bernheim, the condition of hypnosis appears as a normal reaction, a mere form of suggestion to which every person is in some degree subject, the principle of treatment in the two cases is the same, namely: to induce under hypnosis a healthy suggestion with which to offset the influence of a reaction due to the operation of morbid unconscious processes. The method of treatment in both instances is based on the idea that, when there is induced in the patient the receptive, non-resistive attitude characteristic of hypnosis, the harmful mental trend may be overcome and an appropriate impression substituted by means of beneficient countersuggestion. Thus, through hypnosis, the consciousness of the patient is put in abeyance, and access is had to the sphere of the personality that occupies a level below that of conscious perception, that is, in the psychological phrase, the psychic domain below the threshold of consciousness. This psychic realm, attainable through hypnosis, is called by Janet the "subconscious." Thus the field of operation for both Janet and Bernheim is the "subconscious." The much-heralded method of treatment of the French pharmacist Emil Coué consists in systematic autosuggestion in the awake state.

In sharp contrast to the method of the preceding workers is that of Paul Dubois and those who agree largely with him (Déjerine, Camus, and Pagniez, *et al.*). For the especial characteristic of Dubois's principle of treatment is the repudiation of hypnosis and, along with it, of the element of unconscious suggestion as employed by Janet and Bernheim, and the substitution of a direct and rational appeal to the intelligence of the patient, with a view to explaining to him the psychic nature of his disorder and spurring him to combat the condition through a conscious effort of reason and will. It is Dubois' dictum that "nervousness" is preëminently a psychic disease, and that psychic diseases require psychic treatment. Dubois therefore uses the method of "persuasion," his treatment being aimed toward influencing the patient's conscious volition.

That this method is of great value in the types of psychic disorder that are amenable to reason is undeniable, and it has been much employed, before and after the publications of Dubois, by leading physicians in America. In cases thus favorably adapted the method stands vindicated upon a priori grounds alone. For the method is one that aims to set right a mental attitude that is biologically faulty and, perhaps, responsible for the entire disorder. It is preëminently a logical method, for it essays the correction of faulty mental habits acquired by improper training through the substitution of healthier modes of reaction. The weakened will is reinvigorated. Apathy and inertia are routed out through the stimulus of healthy incentives; the negative, reticent attitude toward life, inculcated by the morbid and enervating philosophy of the self-distrusting nervous invalid, is supplanted by the invigorating gospel of optimism and hope. So much for the theory on which the method is based; practically

excellent results are sometimes obtained; but there are many cases in which success is not achieved. Nor does success in getting people well through the use of any given method necessarily prove that the theory upon which the treatment is founded is well based.

Déjerine and Gauckler emphasize the importance of not expecting more from psychotherapy by persuasion than the method is capable of yielding. They point out that the mental mechanism must be fairly healthy for persuasion to be applicable, for attempted in imbecility or in organic disease but little can be expected from it. They assert, too, that there is no psychotherapy in the sense in which they use the term for the marked obsessions, for true melancholia, for circular insanity or for the other insane. When psychotherapy has seemed to be helpful among the actually insane, they ascribe it to its application at a time when a natural or spontaneous remission was occurring. The method of Freud, or the "psychoanalytic method," as he has called it, will be referred to later.

As to the preliminary conditions of an adequate course of psychic treatment the necessity of appropriate conditions of physical hygiene is obvious. Patients must naturally be protected against an unhygienic habit of life, such as insufficient or improper food, disturbed sleep, overfatigue, etc., as such hygienic violations militate seriously against the patient's response to psychic aids. In this connection the preceding chapter may be consulted. Suitable conditions of mental hygiene must also be provided—the avoidance of irritating and depressing surroundings, of an uncongenial atmosphere, and of contact with persons who are themselves of an unhealthy, ill-balanced mental disposition. Hence the urgency, in severe cases, of removing the patient from his habitual environment, and placing him in a different atmosphere, which provides fresh associations. Thus the psychic treatment must, in every instance, take account of the psychological factors pertaining to the patient's external or environmental conditions, as well as of the internal or subjective modifications and readjustments of the patient himself. Finally, it is important to lay emphasis upon the requisite relation to the physician during the period of treatment. The physician ought to become, for the time being, the center of the patient's life. His authority should be absolute, in all severe cases superseding for the moment, by delegation, that of the most responsible of the patient's family or friends. Hence the position of the psychotherapist becomes one of trust, entailing obligations that are as deep and sacred as those involved in any relation in life.

Perhaps one of the most frequent types of nervous condition is that of simple mental fatigue due to overwork and undernutrition with incidental disturbances of digestion, headache, insomnia, depression, and the like. The cause may be obvious, consisting simply of too long and too constant mental application and unhygienic living. This character of neurosis is very frequent in students, teachers, writers, and university lecturers, and

is the natural reaction to forced application, to the strain of arduous professional exactions, and to the wear of unvarying intellectual routine. The rational treatment for such a neurosis consists, manifestly, in the temporary interdiction of close mental work, and the substitution of fresh mental associations through a change of interests and environment. A sojourn in the country, a sea trip, or, best of all, perhaps, a camping expedition, with all the fresh interests necessitated by the needs for such a project, is often alone sufficient to reëstablish normal tone.

Aside from these simpler disorders the functional neuroses with psychic maladjustments may conveniently be considered for psychotherapeutic purposes under two headings: (1) neuroses associated with certain consciously abnormal factors, and (2) neuroses associated with certain unconscious disturbing factors.

The former heading comprises the psychic tangles and disharmonies arising from causes that the patient fully recognizes and frankly avows, at least to himself, but which he may be unable, or fancy himself unable, to adjust. Psychologically the essential condition is a mental conflict, of which the logical description is worry. Worry, then, due to a psychic conflict dependent upon a disharmony among the elements of the patient's affective life may be accepted as the basic factor in the production of neuroses of this order. Where the patient's worries are warranted the treatment consists in advising and, where feasible, directing the removal of the occasions of worry. But where, on the contrary, the worries are clearly unbased, the treatment must be directed, in general, toward inculcating a robust philosophy of life and, specifically, toward increasing the patient's clearness of mental vision through logical discipline, and toward strengthening the resistive faculty through reëducative measures.

We may classify worries as positive or negative according as the conflict arises, on the one hand, from the inadequacy of the patient to the quantitative demands made upon him, or, on the other, from the inappropriateness, or quality, of the demands. In the former case the patient's responsibilities are actually too heavy. They exceed the measure for which his endowments fit him. Hence the patient labors constantly under a disquieting sense of inadequacy, added to which may be the humiliation of finding himself outstripped by his fellows. Here is afforded soil for the development of ideas of insufficiency and a train of self-deprecatory ruminations, fertile enough, perhaps, to promote the growth of the seeds of a neurosis. Even the laity are gradually becoming familiar with the term "inferiority complex." In such cases the primary need is an environmental change. To alter the figure, the burden must be fitted to the back; with this accomplished, that is, when the tasks set befit the patient's equipment, the situation will often resolve itself. In the latter case, that of negative worries, the patient's obligations being qualitatively unsuited to his mental powers, recourse must, in turn, be had to such external read-

justments as will procure for him appropriate and congenial interests and occupations. It would be difficult to overestimate the frequency of this type of disharmony. It is often the result of an ill-chosen business, or of other faults of adaptation in the commercial sphere, and this fact emphasizes the importance of sociological factors in the determination of the psychic health—factors illustrated in the undeniable hygienic asset of "success."

The psychotherapist must, then, to a certain extent assume, as an inalienable function, the task of a social worker, for he is required to take into account the sustaining influence of adequate remuneration for labors performed, and must recognize the psychological significance of pecuniary rewards in standardizing efficiency. Undoubtedly, upon the proper regulation of those sociological relations that are intimately bound up with the economic problem of wage, depends, in very great part, the psychic health of the individual, as a member of the organized social group.

The example just given will suffice to indicate that the psychotherapist has to consider, in every case, the conditions of the patient's environment, and the influence upon his psychic state of these external circumstances. The environmental conditions are summed up by Adolf Meyer in what he calls the "situation," while the response of the individual to these factors of the environment is designated by the same writer the "reaction." Quoting him, it may be said that "it has proved to be much more satisfactory to speak in terms of situation, reaction, and final adjustment and to describe all the facts of intersection according to their weight . . ." ; and again, that "the conditions that we meet in psychopathology are more or less abnormal reaction-types that we want to learn to distinguish from one another, trace to the situation or condition under which they arise, and study for their modifiability." The marshaling of the facts constitutive of the patient's life history is, then, of paramount importance. It is only through an exhaustive inquiry into the details of the patient's life, with a view to gaining possession of all the available facts, that one obtains the data necessary for an appreciation of the essential mechanisms underlying the psychic disorder—that one is enabled to understand the "situation" and the "reaction." Thus, to recapitulate, in studying the ultimate issues presented in a given neurosis the physician has to take account of: (1) the individual per se, that is, the "constitutional make-up"; (2) the factors of the environment, that is, the "situation"; and finally (3) the psychological resultant, or composite dynamic effect of these two components, that is, the "reaction." The points that are stressed by Meyer are (1) the biological bearing of abnormal mental reactions, and (2) the dynamic importance of the environmental influence in the production of psychopathological states.

This brief reference to the analytic method of Meyer forms the most natural transition to a discussion of the specific psychoanalytic method

of Sigmund Freud. The positions of Meyer and Freud show a close resemblance, since each insists upon the study of the psychogenic influences traceable in neurotic disorders.

In approaching the method of Freud we come also to a discussion of the neuroses due to unconscious factors mentioned above. In many fundamental respects Freud's teaching marks a wide departure from the hitherto prevailing view as to the interpretation of psychoneurotic states. On account of the widespread interest now manifest in the subject it would seem desirable to present here a brief synopsis of his doctrine. In the first place, Freud ascribes all psychoneurotic disorders to the existence, in the patient, of wishes that are unrecognized (that is, not directly envisaged) by him. Wishes of this unacknowledged character are subsumed by Freud under the term "unconscious"; to the realm of psychic activity constituting the abode, as it were, of such unconscious trends he gives the name of "the unconscious" (*das Unbewusstsein*). Secondly, Freud regards a psychoneurosis as a spontaneous expression of the tendency toward the fulfillment of such unconscious wishes. Thus he ascribes to the neurosis a purposive significance—a moral import. The neurosis contains a motive. It embodies an underlying intention and tends to fill a void not clearly recognized and defined, because existing in the margin, outside the focus, of consciousness. Thirdly, according to Freud, the ideas or wishes that thus occupy the sphere of the unconscious possess the generic character of being, invariably, such as are ethically inadmissible by the full consciousness. Thus the psychological explanation of the creation of this limbo of the "unconscious" is to be found in the psychic conflict that arises from the opposition of consciousness to these ethically unwelcome desires, and in their enforced banishment by the tribunal of upper consciousness—a process that Freud calls the mechanism of repression (*Verdrängung*). A psychic conflict, with the attendant repression of the unseemly element, is, therefore, if Freud's view is correct, the basic factor in the production of the neuroses. Fourthly, it is Freud's thesis that all such conflicts as issue in such unconscious repression have their ultimate basis in the sphere of the sexual instinct. In other words, Freud posits a sexual etiology as an essential condition of a neurosis. And, lastly, Freud's theory assumes that such symptoms as are the expression of a tendency to gratify these forbidden instincts are but an indirect, cunningly veiled representation of them, the surrogates being employed by reason of some associative affiliation with the original underlying desire. The manifestations of the neurosis are, he believes, the dramatic portrayal of the fundamental repressed wish, subjected to a process of modification, effected by a consciousness trying to evade the real import. The symptoms of a neurosis are, in each instance, the resultant of contrary and opposed psychic trends, and represent a compromise between the two.

Such remodelings and distortions of the expressions of the brute,

primitive instincts as appear in the symptoms of neurotic disorders Freud refers to as phenomena of "unconscious symbolization." It is this unconscious symbolization of instinctive trends, through which the palliation, made necessary by the censure of a conventionalized consciousness, is brought about, that is the main feature of Freud's interpretation of the psychoneuroses.

According to Freud the instinct of reproduction is paramount in the life of the individual, but the sensations contributory to this impulse are originally composed of dispersed and inarticulate components, having their seats in various erogenic zones located over the body surface, and constituted chiefly of the regions of the orifices of the body (for example, mouth, anus, urethra). The sensations arising from such erogenic zones, though present in earliest infancy, as scattered, incoherent elements, become combined and unified later, he thinks, giving rise to the characteristic sexual feelings pertaining specifically to the organs of reproduction in later life. The ultimate development of the instinct directly conducive to the biological goal of reproduction consists, then, of a process of integration, which represents a product of individual evolution.

Freud teaches that there are, broadly speaking, three possible courses open for the development of the ultimate sexual life of the individual. First, the sexual life may take a normal course, leading, at puberty, to the integration of the various scattered auto-erotic trends into the resultant allo-erotic instinct included in the ultimate reproductive quest; here is a new sexual goal (in the male, the seminal ejaculation), having its physiological center in the organs of generation and requiring a subordination of all the erogenous zones to the primacy of the genital zone. This primacy of the genital zone, together with the finding of the heterosexual object, are indispensable transformations if the development is to result in a male individual of normal sexual life. In the female there is normally, at puberty, a repression of the erogenic zone of the clitoris with gradual transfer in normal cases to the introitus vaginæ, a feature of development that Freud holds to be of enormous importance for the origin of neurosis and especially of hysteria in the female. Secondly, there may be abnormal development either in respect of the sexual object or sexual goal due to persistence of the original auto-erotic interests, and of the sexual satisfaction attaching to the primary erogenic zones, with failure of the aforesaid integration into the sexual impulse that tends toward the normal biological goal of reproduction. In this case there are presented the variations of the normal sexual impulse that constitute the different *perversions* (homosexuality, exhibitionism, fetishism, sadism, masochism, etc.). Finally, there may be a form of development of the sexual life that is associated particularly with the psychoneuroses (hysteria, compulsory neurosis, or psychasthenia). According to Freud, the neurotics are all persons with inherited predispositions (psychosexual constitution)

who have strong perverse sexual impulses, but these impulses have in the course of development become repressed and unconscious. By psychoanalysis traces of homosexuality, of failure of integration of the primary erogenic zones and partial impulses, and especially of the persistence of contradictory pairs of perverse impulses (active and passive) are discoverable. The symptoms of a psychoneurosis are, Freud believes, the expression of the sexual activity of the patient in the widest polymorpho-perverse sense. The patients retain, to a certain extent, the infantile standpoint as regards sexuality, but with this difference, that the sexual impulses do not come to conscious and active expression, but are repressed and, working in the "unconscious," can manifest themselves only in the form of inhibitions; the neurosis is the negative of the perversion.

Breuer and Freud, in their *Studien über Hysterie,* developing the earlier ideas of Breuer (1880-1882) regarding the cure of hysteria by awaking, by means of hypnosis, memories of an earlier psychic trauma, together with its associated emotion—the so-called "cathartic" method—had suggested that the hysterical symptoms are the after-effects of the psychic trauma, the disagreeable emotional accompaniment of which, owing to special conditions, had been suppressed, side-tracked from the conscious psyche, and had given rise to an abnormal innervation somewhere in the body (phenomenon of "conversion"). In patients devoid of this tendency to "conversion" the idea, cut loose from its emotional element, may remain in consciousness, side-tracked from all association, while the emotional element becomes transferred to some other idea, not unbearable in itself, but made so (in an obsession) by the false attachment to it of the transferred emotion (phenomenon of "substitution"). According to this view, hysteria and psychasthenic states (compulsion neuroses) are both instances of "failure in psychic self-defense."

Freud, studying the psychoneuroses further, concluded that the psychic trauma is not, by itself, sufficient to account for the symptoms, but that contributory thereto is the memory, awakened by association, of earlier sexual experiences, usually pertaining to the period of puberty. Pushing his analysis still further back, Freud has arrived at the idea that, behind the sexual erotic experiences at puberty, there stand infantile sexual experiences far more uniform in kind that those of puberty. Though these infantile experiences exert but little effect at the time of their occurrence, the psychic influence in later periods of life may be very much more significant. The effect is brought about, he thinks, by reminiscences of these premature sexual experiences, especially during the period of erotic imagery at the age of puberty. As the central complex of the neuroses, Freud regards the kind and degree of the psychic relations of the developing child (1) to its parents and sibs (Œdipus complex, etc.); and (2) to the problems of birth and generation connected with these relatives. Psychic experiences of this sort come to all children; in order that a neurosis shall

result, a quantitative excess, and an inborn tendency, are assumed, the latter being responsible for a premature and excessive development of the sexual instinct. Studies of hysterical patients have revealed, to Freud, in most cases a mental conflict between an excessive sexual repression and a preternatural need of sexual satisfaction. The outbreak of the symptoms of hysteria comes in predisposed persons in later life as a "way out" of this conflict; the conflict is not solved, but an attempt is made to escape from it by transforming the libidinous desires into symptoms.

Such are some of the fundamental ideas of Freud's teaching in regard to the origin and development of the psychoneuroses. The primary factor in the production of the disorders is, he believes, the repression of the person's sexuality, due to the ban set upon the manifestations of this elemental instinct by the strictures of social and religious convention. It is the conflict between the forces of artificial culture and those of an inherent instinct of sex, the former imposing the repudiation of sexuality, the latter insisting as resolutely upon a due recognition of the basal significance of this elemental factor in the biological economy. The sexual instinct stoutly insists that it be granted recognition in consciousness, and consciousness, in its narrow intolerance, is as fiercely resolved to debar so unseemly an intruder, to subject it to repression because it is unbearable. The situation leads to a compromise. It is agreed that the unruly element be admitted to consciousness, on condition that it soften its tone and, as it were, adopt a conventional apparel conformable to the requirements of a sophisticated consciousness. Thus it is only through dissembling that the repressed complex can succeed in evading the anathema of the conscious censor. But, though disguised, this discordant, outlawed element still lurks in the unconscious, where, acting surreptitiously, it incites dissension amid the constituents of the personality, impairing its unity and destroying the mental synthesis requisite to the purposes of concerted function. The repression, leading to the neurosis, is not wholly successful, therefore; the repressed desire waits for its opportunity to send a distorted, unrecognizable substitute, the hysterical symptom, or the psychasthenic obsession or phobia, into consciousness. A psychic repression being the essential feature of a psychoneurosis, the question for psychotherapeutics, Freud believes, is: How may disorders arising from a psychic conflict with arbitrary repression from consciousness of contraband associations be remedied? Freud, seeking to give a direct, logical answer, contends that disorders embodying psychic conflicts due to repression of elements that have a right to tenancy in consciousness are effectually to be cured only by removing the repression and frankly admitting such elements to their hereditary rights.

Since the psychoanalysis per se constitutes the entire method of the psychotherapy employed by Freud, simultaneously revealing the etiology and effecting a cure, an adequate account of the psychoanalytic method

would entail a full description of its technic. The technic, however, of psychoanalysis has to be varied so much in different cases, and at different times in the same case, that it is scarcely possible definitely to formulate it. One of the chief technical resources, however, is the analysis of the patient's dreams; the dream is taken as a path leading into the "unconscious." The practical procedure followed in the analysis of dreams may here be broadly indicated.

The patient, having repeated his dream, is asked to relate quite freely whatever occurs to him on presenting to his mind the different elements of which the dream is composed. This Freud calls the method of "free-association." From the ultimate ideas at which the patient arrives at the end of each of the chains of associations leading from the several elements of the "manifest dream-content" the physician may be able to reconstruct the underlying trend contained in the "latent content" of the dream and so discover the patient's dream-thoughts, that is to say, "interpret" the dream. The links in the chains of associations do not succeed each other at regular temporal intervals but, frequently, the patient halts and shows signs of discomfort and unwillingness to continue. Freud assumes that in such instances the patient's flow of thought is blocked by "resistances," that is, he has come upon a trend of thought that he has previously put away from him as distasteful, as unfit to hold a share in his consciousness. In other words, one comes at such moments upon psychic material that has been subjected to the process of repression and which, with its clusters of associations, constitutes a deterring "complex" in the patient's psychic life. Now it is precisely the release of the emotional tension belonging to these repressed reminiscences and constituting such a complex that is the central therapeutic aim of psychoanalysis.

In order to pass from the "symbols" of a dream to the "repressed element" that is symbolized, Freud has tried to develop an "art of interpretation." The work of analysis is often interrupted by the "resistances" offered to the discovery of the repressed elements. The discovery and removal of these resistances are the main task of the technic. Each resistance overcome gives access to new "unconscious" material. In a sense, the cure of hysteria, according to Freud, consists in the removal of the amnesias. By filling up the gaps in memory and explaining the puzzling effects of the psychic life the continuance of the malady becomes, Freud thinks, impossible. In making the "unconscious" conscious by overcoming the "resistances" the psychoanalyst acts as an educator, one who overcomes "childhood-residues"; though the work is never complete, one can be content if he effect a "practical cure"—the "restoration of a capacity for work and love."

Next in importance to dream analysis in this form of psychotherapy is the association experiment, introduced by the Wundt school, which Jung, of Zurich, has adapted to practical psychoanalytic application. The

association experiment is useful, chiefly for the purposes of a long-continued study of some specific problem, for example, that of differences of reaction-types and as an instrument of diagnosis. But it is also most valuable to the student in beginning psychoanalysis as a means of obtaining a preliminary survey of the general reaction of the patient and of opening the way toward gaining insight into his unconscious mental processes (discovery of resistances and painful complexes).

As to the indications and contra-indications for the psychoanalytic treatment, Freud and his followers concede that the cases for which psychoanalysis is suitable are to be very carefully discriminated. It is advised especially in the "true" psychoneuroses (in the sense of Freud)—that is, the neuroses due to a psychic conflict in consequence of unconscious repressions with associative substitutions (hysteria and the compulsion neuroses with their phobias, obsessions, impulses, etc.). The anxiety states, caused by existing irregularities of the *vita sexualis,* disorders remediable by direct removal of the exciting sexual irregularity, are not included here, nor, it would seem, are the fatigue states, due to a depletion of the neural structure through a chemical alteration in the molecular substance of the neurones. These disease complexes are due primarily, Freud thinks, not to psychological factors, but to organic processes caused by direct physical strain. Psychoanalysis, as a therapeutic measure, is said to be most helpful in the psychogenic disharmonies, such as hysteria, and the compulsion neuroses, including the phobias and obsessions usually subsumed under the term "psychasthenia."

It has been objected against therapy by psychoanalysis pushed to the infantile period that the treatment is not appropriate in all cases of psychic disorders. It has been held, for example, that the association or habit-neuroses are sufficiently accounted for on the ground of their being persistent and exaggerated reactions due directly to the unconscious survival of past impressions that are of significance to the ego by reason of the strong emotional complex originally accompanying them. It is claimed by Morton Prince that such mechanisms are of themselves sufficient to account for many phobias, anxiety and obsessional states, without the need of invoking still other psychic incidents presumably anterior to these apparently primary affects, these latter being themselves but the reactions to former buried reminiscences. That is, it is held as unnecessary to assume the presence, in the unconscious, of those remote, infantile experiences such as the Freudian hypothesis regards as the essential etiological factors in the production of the neuroses.

One of the chief objections to psychoanalysis is made upon practical grounds. It is contended that the time required for the treatment of a psychoneurosis by the psychoanalytic method is so long that it is not often feasible and that, for the same reason, the treatment becomes too expensive to be accessible to other than well-to-do patients.

Some of the opponents of Freud's teaching are horrified at, and repelled by, the idea that sexual factors are responsible for the neuroses; even those who grant an important rôle to sexuality in certain cases deny that it is the essence of every case. Particularly obnoxious to many objectors is Freud's tendency constantly to hark back to "infantile sexuality" as the main psychogenic factor in the mental disturbance; these objectors feel that the "hidden complexes" are sometimes "talked into" the patient in order triumphantly to be dragged out again to satisfy the preconceived idea of the examiner, and they fear that harm may be done in leading the thoughts, especially of hysterical or psychasthenic girls, into sexual channels.

In reading the bibliography, one gets the impression that some of the opponents, as well as the adherents, of the views of Freud have become almost fanatical in their partisanship. We would urge that physicians, for the present, keep their minds open, and that they be on guard against being led astray or frightened by extremists on either side. It should be remembered that most physicians have been brought up in an anatomical-pathological-chemical school, and that very little attention has, hitherto, been paid to psychological studies in the medical colleges. It is well, too, to understand that the term "sexuality," as used by Freud, is much more inclusive than the coarse sensuality often meant, and that, in employing it, he refers, not to physical sexual activities only, but also to amatory imagery in the widest sense. Certain it is, that many who have given Freud's psychoanalytic method a trial in the treatment of psychoneurotic states have grown ever more enthusiastic over it. A considerable personal experience in the trial of it in the treatment of hysterical and psychasthenic patients should, it seems to us, precede any strong expression of opinion either in favor of or against it.

TREATMENT OF HYSTERIA

Smith Ely Jelliffe

"All that glitters is not gold." It is equally true that everything that shows hysterical phenomena is not hysteria. In any consideration of hysteria it therefore becomes of paramount importance to give some definite expression to the subject under discussion, and to separate, as far as possible, the clear-cut and central factors from those outlying features which tend to confuse the main issues.

This mode of approach is necessary in all fields of medicine. Modern advances in physical, biological, and chemical research have done much to sharpen our nosological concepts, thereby rendering the application of therapeutic measures understandable. In the particular field of psy-

chiatry it may be said that the onrush of research has done as much, if not more, than in all other fields, but there are intrinsic difficulties and complexities which have not yet received a complete solution, giving the entire field an aspect of incompleteness which to the lay mind is more than confusing. In no corner of this field is this more apparent than in the domain set apart for hysteria.

Hysteria has been called the "enigma of personality." It was such for the ancients and remains one of the most actively discussed problems at the present day.

Its descriptions have entered into legends and folklore long before historical records were made. The most ancient books of the East contain in unmistakable outlines many descriptions of the phenomena precisely as we see them at the present day. The poems and plays of Homer and Euripides show its chief features as well as the writings of the modern of moderns, Ibsen. Historians at all times have had to deal with the hysterical personality. Judges and law makers have been confused by its contradictions and its inconsistencies. Priests, lawyers, philosophers, physicians, and laymen have endeavored to understand it in all ages and in all climes. Hypothesis has replaced hypothesis; societies have been disrupted and sects rent in twain in expounding its nature. No question can create as much acrimonious discussion in a modern medical society as that of hysteria. No unanimity of opinion has ever been reached, yet there are numerous evidences to show that some settled basis is being formulated.

There are many reasons for all this. Much of the discussion would be rendered useless if people would agree as to what they are to discuss. W. James has put it well in his valuable study of Pragmatism. It all depends upon what one means by "going around the squirrel." Words are only symbols representing things—but they are fluctuating and not immutable symbols, and one readily perceives that the most active of modern disputation concerns itself with variations in the significance attached to the symbols rather than to the things themselves.

It therefore becomes imperative that a preliminary statement be made of what the viewpoint will be in the present chapter. The author who would write upon hysteria has many to choose from, even should he not have arrived at personal convictions.

Even the arriving at definite and fixed ideas regarding a subject so very intricate has its dangers, for so detailed has become the analysis of personality of recent years that concepts long cherished as apparently incontrovertible have been overthrown. Thus the immutable gap that has separated hysterical amnesia from that of epileptic amnesia has been definitely bridged by the researches of Maeder, and it is no longer tenable to maintain as a proved dictum that epileptic amnesia is absolute and that this should constitute an infallible differential from hysterical amnesia.

Recognizing the great difficulty of picking out from the neurotic and

psychoneurotic medley any single group with uniform features not shared by any other members of the group, we purpose first to show what we shall *not* consider as hysteria, and as briefly as possible.

We shall exclude from our discussion those patients whom Déjerine (1) has so well termed the "fausses": false gastropaths, false enteropaths, false cardiopaths, false genitopaths, etc. They are not a homogeneous group by any means, and unquestionably there are hysterics, in one sense, among them, but these are patients whose symptoms are largely the product of medical faddism. There are a large number of these purely manufactured products, not the products of suggestion, but of direct education. The less said about them the better, for there are plenty of modern Molières to criticize present-day fads in medicine.

We shall exclude the neurasthenia group. In this we recognize two fairly distinct classes: a neurasthenia proper, congenital or acquired, which is, we believe, a comparatively rare disorder; and the anxiety neurosis of Freud, which general class increasing experience serves to show to be a fairly definite group with a comparatively uniform etiological factor. Stated all too didactically neurasthenia here means nerve fatigue, due to a definite and ponderable factor. There must be some concrete toxic or infectious or overwork factor, not a hazy surmise but a real thing, a typhoid, influenza, lead, syphilis or similar outside agent. The anxiety neurosis group is made up of patients who are also suffering from definite thwarting of the instinct of reproduction. Crudely stated they are struggling with sexual repressions which are not very unconscious and they are unable to handle them at higher social levels and hence with the concrete mechanical factors noted get sick.

We would exclude the dementia præcox group from our consideration, although this is manifestly an extremely difficult task. In both hysteria and dementia præcox mental mechanisms are disturbed in very similar ways and differ apparently largely in a quantitative rather than a qualitative direction. The dementia præcox patient becomes much more involved in his complexes and they become incapable of discharge by adequate reactions.

Jung, in his masterly study on dementia præcox, has drawn a striking parallelism between this disorder and hysteria, and clinical experience constantly meets with the problem of diagnosis. Thus the emotional apathy of the patient with dementia præcox resembles very closely and is conditioned by similar mechanisms as the "I don't care" attitude of the hysteric. Jung speaks of the tendency for the indifference of the hysteric to suddenly blow off in a sudden wild period, a crying spell, or a burst of rage; quite similar affect discharge takes place with the schizophrenic or dementia præcox patient, but it usually takes a more refined method of probing to get at the complex in the latter case. Yet when the analysis has reached the sore spot the mask of apathy of the dementia

præcox may be made to disappear, with quite as tumultuous an explosion, if not more so, than with the hysteric.

Even the feeble-minded, the idiot, and the imbecile show such explosions conditioned by the same factors. As a rule the schizophrenic guards his complexes more zealously. He shows more blocking to adequate discharge.

In hysteria, as in dementia præcox, we find affective states without any adequate ideational content. There are obsessional hysterics, suffering from great anxiety, who are thoroughly aware of the groundlessness of their anxiety. They say there are reasons but they cannot give them. They are buried deep in the personality. Similar obsessive ideas are present in schizophrenic cases.

Speaking of character similarities, Jung has also called attention to the fact that one cannot in reality speak of a hysterical character. Hysteria creates no character, but it does exaggerate existing conditions. All types may be found among hystericals. Saint and sinner, rich and poor, altruist and egoist, the passionate and the frigid—all are capable of the hysterical mode of reaction. There exist within such individuals powerful complexes which are in conflict—at war—with the ego complex.

The external mannerisms, affectations of speech, of voice, of gait, originality, stupidity, are met with in the hysterical precisely as in the schizophrenic. In both it is very frequent to see the aristocratic gaits, the literary enthusiasms, the aping of the mode. In both the mechanisms are caricatures of the normal.

Regardlessness, narrow-mindedness, and an inaccessibility to persuasion we find both in the physiological and pathological spheres, especially when accompanied by effective causes. Under certain conditions there need only exist a firm religious or other conviction to make a person careless of others; cruel, and narrow-minded. Most reforms and reformers show this mechanism beautifully and few followers in a reform realize that they are seeking their own selfish ends under the guise of something laudable. This same mechanism is very frequent in both hysteria and in dementia præcox.

It must not be forgotten, however, that whereas the resemblance is clear they are not identical, since in the schizophrenic the reaction is buried deeper and may be complicated by organic factors as yet not understood. Possibly some future worker in the complicated anatomy of the "striatum," that large station which receives the full brunt of all our sensory impressions and which elaborates the primitive feelings, may give the key to this enigma. At the present time one can only speculate.

In the intellectual sphere precisely similar anomalies are found in both disturbances. The so-called dementia of schizophrenia is more apparent than real, a fact well recognized by Kraepelin some years ago, and

more recently emphasized by Bleuler. The narrowing of the field of consciousness is a very striking anomaly.

Janet, in speaking of the hysteric, calls attention to the suppression of the intellectual faculties and to the difficulty in fixing the attention. Vague preoccupations fill their minds, and they cannot be interested in a work assigned to them. This is a precise description of many schizophrenics. The hysteric returns to his story, his phantasy, his fabrication—his whole being is for the time constellated about his complex. This is also true for the paranoid schizophrenic, only he is more deeply constellated. The hysterical may be dislodged from his stronghold. A therapeutic Siegfried may rescue the shut-in Brunnhilde, but as yet we know of no knight's move to get the paranoid schizophrenic out of his delusional castle.

The hysteric is not free from hallucinations, nor from delusions. Indeed, these are common materials in the building of all mental disorders. Even mental health utilizes them. The content of the hallucinations and delusions is the interesting thing. Hysteria, the A, B, C psychosis, if one may so express it, affords an excellent glimpse at more serious disturbances. Thus we may regard, with Jung, obsessive ideas as being parallel with delusions; so also the narrow-minded prejudices, so frequent in hysteria, and in many apparently healthy people; even the stubborn headaches and bodily pains of hysteria are analogous mental mechanisms.

Thus one may see how close mental health lies to mental disease, and also why narrow-mindedness, prejudice, and bigotry are responsible for so much conflict in the world. They are the grit, as it were, which causes the mechanism to wear, and finally break down, and thus become unadjusted to proper functioning.

Finally, in the motor sphere one finds striking analogies between the two states, especially in the phenomena known as stereotypies. These patients become, so to speak, decerebrate automatons. Jung thinks it daring to speak of certain catatonics as such, yet they certainly are such to all intents and purposes, for a time at least. Kleist has elaborated Wernicke's ideas and has attempted anatomical explanations of these phenomena.

Southard's work on the cerebrum in dementia præcox supports Kleist's view, yet Isserlin's objections are well founded when he points out the incompatibility of durable lesions and transitory functional disturbances.

Without entering further into these analogies, enough has been indicated to show how closely related the schizophrenic may be to the hysteric. We are not now concerned with differential diagnosis, but are only pointing out analogies because they may be made of therapeutic service later.

It is further useful to utilize Jung's concept of extroversion and introversion types in this sizing up of the differences between schizophrenic and hysterical reaction types. The typical schizophrenic is introverted. His creative energy (libido) is devoted to self, to internal contemplations,

to early auto-erotic and narcissistic satisfactions. The hysterical mechanism is a direct antithesis (ambivalent). Here extroversion of the libido is the mode followed for solving the mental conflict. The hysterical has, therefore, much free floating libido to attach to the external object. Inasmuch as this object is more often the physician than any one else, it is highly important to understand this phase of the hysterical mechanism.

We do not purpose to deal with the group called "psychasthenia" as outlined by Janet. From our viewpoint, this is a thoroughly artificial grouping of symptoms occurring in patients suffering from schizophrenia, hysteria, manic-depressive psychosis, alcoholism, hyperthyroidism, neurasthenia, and other fairly well-defined disorders. It is not a valid nosological group—any more than "ascites," "headache," or "jaundice."

In other words, nothing is to be gained from the therapeutic point of view by considering psychasthenia as a nosological entity, and failure will only come from such a consideration in treatment, for it is manifestly improper to treat a patient suffering from a manic-depressive psychosis, in which phobias and obsessions are prominent, in the same manner that one would treat a beginning dementia præcox having the same superficial picture of phobias and obsessions. It is particularly from the therapeutic point of view that Janet's conception of psychasthenia is, in our opinion, so unfruitful.

Manic-depressive psychoses have to be differentiated from hysteria very frequently. One of the commonest mistakes in diagnosis is the confusion of these two pictures. It is only by the proper application of the psychoanalytic method that one can make a differentiation between patients whose disease pictures superficially resemble one another. A severe hysteria is frequently mistaken for a "melancholia." Only a sympathetic attitude toward mental facts will enable one to get at the real issues.

Association tests frequently reveal the faulty mechanisms. It is impossible in this place to enumerate the differentiations that Jung has pointed out. Reference must be had to his valuable diagnostic association studies if one would grasp the significance of this method of analysis.

Finally, the various grades of feeble-mindedness must be brought in close association with hysterical phenomena. So true is this that Steyerthal has gone so far as to say that practically all hysteria is nothing but neurasthenia on a feeble-minded basis. We are not prepared to accept this view, although there are many suggestive features in the statement, for certainly the hysterical reaction is a primitive type of reaction, and, in so far as its primitiveness is concerned, is to be looked upon as a feeble-minded type of reaction. Still, there is considerable difference between considering the hysterical reaction as a feeble-minded type of reaction and considering hysteria as essentially a feeble-mindedness.

These remarks only emphasize the significant fact that one would expect to find a hysterical reaction in people of a more feeble-minded type—

indeed, the comparative studies of Kraepelin in Java demonstrate this—and thus the combination of feeble-mindedness and hysteria must be considered as extremely common. It is perhaps the commonest combination that one meets in practice, and is, moreover, an extremely important feature of the situation when the subject of treatment is to be considered. Real feeble-mindedness is here viewed from the aspect of structural defect. There are many pseudofeeble-minded wherein the difficulty is due chiefly to emotional blocking. There is no real anatomical defect, the disturbance is truly functional. These cases are best grouped with the hystericals rather than with the feeble-minded. Many very brilliant minds, struggling in adolescence with large psychical problems, have been diagnosed by stupid pedagogues as feeble-minded. Later they have overcome their difficulties and become large figures in the world of science, politics, etc.

Enough has been said to indicate that the viewpoint of the present chapter is that hysteria is primarily to be considered as the expression of a particular reaction type. Those individuals show hysteria who show a certain method of meeting certain situations, which situations occur in their social environment.

These modes of reaction become habitual, and are distinguishable from average modes of reaction solely by reason of their greater frequency, greater intensity, and greater number. This means practically that every individual has hysteria possibilities, certain individuals have hysteria probabilities, while others, again, are the real thing.

Without discussing in detail all of the various hypotheses concerning these reaction types, and the causes for the same, we feel that the most fruitful line of inquiry is that offered to us by Freud and his students. We do not mean by this that we are prepared to accept in detail all of these teachings, particularly those related by his followers, but we believe that, previous to the researches which began with Charcot, were further extended by Janet, and finally brought to practical objective demonstration by Freud, nearly all of the studies on hysteria failed to arrive at a definite dynamic conclusion and hence were on the way rather than arriving.

It has been admitted for years, even centuries, that in all organic nature two important impulses stand out from all the rest—the impulses, instincts, or forces that make for perpetuation of the species, that is, for race propagation, and those forces that make for the protection of the individual, that is, for the struggle for existence. In comparing these two paramount forces, it is recognized that the race must continue, but the individual must die. This is the rule in all higher forms, although it has been taught that in some of the lower types, among the infusoria, for instance, there is no such thing as individual death, and that race propagation and self-preservation are coincident and co-equal. However this may be, it is not true for any of the higher forms of life. It there-

fore becomes of the most practical importance to trace the development of the expression, and the interaction of these two great forces in human life, if one is to be able to explain the phenomena of conduct.

One might compare the forward drive of life, roughly called the "libido," to two fiery animals which must be controlled. The forces of civilization are the harness by which they must be guided—convention, modesty, chastity, convenience, honesty, law—one might go on and enumerate thousands of the bits of harness that society has imposed for the control of the animals. This is a rough figure, but much human conduct and behavior can be interpreted by keeping it in mind. The tremendously complicated mutual interplay of the two forces constitutes practically all of the activities of the human mind, conscious and unconscious.

The fundamental postulate of the teachings which have appealed to many students of the present time maintains that in the psyche of the hysterical there exist certain constellations of affects, or complexes. These are primarily associated with these two large forces which determine all conduct, and their alliances with those of the libido particularly are most prominent. In the hysterical the unknown and unappreciated libido will not down. It has not found its proper forward task. Therefore, the libido, in the larger sense, introverts, and, flowing in regressive channels, takes hold of infantile phantasy. It therefore must needs have some expression, but such expression must conform to certain recognized formulæ. Being barred such expressions, often self-imposed, it therefore suffers a *conversion* into some form of physical or mental malady. It can then be made a subject of careful attention and solicitous apprehensive care on the part of those about the hysterical individual, and in the converted hysterical symptom, be it paralysis, or blindness, or deafness, or any of the thousand and one various physical symptoms possible, the individual seeks and obtains his relief.

Thus if the transference is temporarily fixed upon a gynecologist, the symptoms will be gynecological; if a surgeon, surgical; dermatologist, dermatological, etc., etc. The classical hysteria collection of conversion symbols will box the medical compass. This is the explanation of the old and well-recognized fact that hysteria "mimics all diseases." It also explains why all forms of therapy will show successes. But these are purely the result of superficial rapport. They are a symptom but do not modify the capacity for making new ones.

This is but a very hasty sketch of the *mechanism of conversion.* It has been made short because various mental mechanisms have already been discussed in this book in the chapter on Psychotherapy. In this chapter one may find the main outlines of the modes and methods to be pursued in the analysis of these hysterical patients.

The point to be emphasized then is that the term hysteria is reserved for a special form of conversion mechanism. The libido of the patient

in its endeavor to extravert, to get attached to some external object, that is to establish a transference (rapport), creates, through some somatic channel, an object of interest, that is, the symptom. This symptom is usually symbolic of the conflict and it is capable of countless modifications, according to the transference needs.

Inasmuch as the treatment of an individual suffering from a form of disturbance which we call hysteria must take the personality of the individual subject largely into account, it is not to be wondered at that no two individuals will be in full accord in all of the details of a particular case. Therefore, one finds that one author accentuates one feature in psychotherapy, and another another. This is due largely to the fact that they may be dealing with different individuals. It is quite conceivable that one student should lay stress upon the value of hypnotism, in contrast to the value of psychoanalysis, if the former has in mind that mixture of hysteria and feeble-mindedness which is incapable of reacting to the intricacies of the psychoanalytic method. Such feeble-minded, or stupid persons are most effectively reached by hocus-pocus, be it in its refined scientific form, hypnotism, or in a much more crude form of quackish methods.

For the true, outspoken hysteria, with evident conversion symptoms, we feel that the best mode of approach is the psychoanalytic method. This does not mean that all such patients will require months and months of treatment by any manner of means. Many of such patients apprehend the idea of the mechanism in a few hours. They are anxious to get well, they grasp in a moment the tricks that the nervous system is playing upon them, and they are enabled to carry out their analysis and obtain relief in a very short time. Others, however, in whom the relief-seeking conversions have been thoroughly established for years, and in whom habitual reactions have become a part of their very being, often require many months of careful analysis, and of coincident careful reëducation.

Hypnotism, psychoanalysis, reëducation, these are the usual weapons used. The end and aim of all is reëducation. The most capable of the tools, not for all cases, but for the most difficult, is psychoanalysis. Without it a comprehensive rehabilitation of the attitude of the individual toward life, toward himself, and his difficulties we feel can never be gained. It is recognized that for many patients such a mode of procedure is time thrown away. We might compare the use of psychoanalysis to the use of cathartics. There are many patients for whom a single cathartic relieves a disturbing constipation. There are others who require months of treatment to overcome a difficulty in the bowel function, and it is just as absurd to assume that the single dose of cathartic will heal a chronic condition as it would be to start a long complicated dietetic régime upon a patient, for whom a grain of calomel would settle the whole difficulty. So in the problem of hysteria it is equally true that for some patients a word of common sense, a strong insistent personal ap-

peal, especially in the beginning, will entirely overcome and reëducate a starting hysteria reaction, whereas for others it requires months and months of careful, patient treatment. The practical therapeutic difficulty is in being able to recognize the extremes, and the various gradations in the means, and to apply the appropriate gradations in successful treatment.

Psychoanalysis has given a sharp-edged tool to get at a certain number of extreme cases, which heretofore had been the most difficult in the domain of medicine. It moreover provides a most fascinating tool for the physician, one that enables him to get into the personality of the patient in a manner hitherto unappreciated, save, perhaps, by the poet, who, by means of his peculiar composition, has always possessed such an instrument. Without the psychoanalytic viewpoint the dynamic evolution of the situation cannot really be unearthed. Anything short of complete (that is, practical) comprehension of the patient's conflicts and their resolution by analysis leaves the patient in much the same condition as before treatment.

One word may be said regarding physical adjuncts to the methods already outlined. It is self-evident that if, in the course of the treatment of a hysteric, difficulties of a purely physical nature arise, such should be corrected. It is highly important that no undue emphasis should be laid upon such disturbances, because they frequently provide a fixation point, as it were, for the converted mechanisms to settle upon. It is for this reason, furthermore, that extensive electrotherapeutic and hydrotherapeutic measures and other forms of therapy should be used with a clear comprehension of what one has in mind. It is not honest nor fair to the patient to make him rely on physical modes of therapy as the real healing methods. They are accessory. They are helpful. They are useful for improving the physical tone. They are highly desirable in many cases in relieving the tedium of an otherwise unoccupied day. They provide change in direction of thought and interest. They should also be utilized by the physician as opportunities for reëducation.

The patient should be told exactly what the action of the physical agents really is, that they can go a certain distance but no farther, they are contributory to the cure, but that real adjustment must come from the mental side, readjustment of the individual to the eternal verities of life.

TREATMENT OF THE MIGRAINES

Smith Ely Jelliffe

Three general groups of migraine headaches may be distinguished: ophthalmic migraine, the more usual and classical type; ophthalmoplegic migraine, which is an unusual type, complicated by signs of ocular palsies

of various degrees; and symptomatic migraine, associated with organic disease of the brain. The last has been already partly considered in the section on intracranial growth headaches; ophthalmoplegic migraine calls for the same treatment as a migraine plus a possible organic cause (syphilis, tumor, etc.).

Ophthalmic Migraine

(*Hemicrania, Sick Headache*)

This general type of headache has been known and described for centuries. Aretæus, Celsus, and Galen wrote of it. Galen apparently gave the name "hemicrania" from the frequent unilaterality of the disorder. Tissot in 1784 wrote a monograph which was authoritative for ninety years, to be superseded in 1873 by that of Liveing on *Megrim,* which still remains an invaluable classic.

A well-marked attack of ophthalmic migraine is classical and stereotyped. The earliest descriptions leave little doubt as to the nature of the headache. The patient first notices peculiar eye sensations, a faint blur appears as one reads or looks at an object, partly obscuring the vision. Then chilliness supervenes and the blurring becomes more marked, and peculiar zigzag scotomata (fortification scotomata, often colored) appear. The chilliness becomes more manifest, and then a soreness comes on one side of the head, often behind the eyeballs, and gradually pervades one side of the head, becoming more and more intense. The scotomata disappear after from five to thirty minutes. Nausea and vomiting may develop; the headache, which has become splitting, now increases on the slightest exertion; bending over becomes impossible. Finally, after this condition has persisted from a few hours to a few days, the patient becomes perfectly well.

While this bare recital of events is sufficiently characteristic to afford a diagnosis for the clear-cut types, the symptomatology of ophthalmic migraine is much richer and infinitely varied. There are very few individuals who at some time in their lives have not had an attack of ophthalmic migraine, and a large proportion have had one or more of the classical type here outlined, but the full-blown attack is also comparatively rare in comparison with the abortive or variant migrainous attacks.

It is very significant that sufferers from migraine are keenly alive to the variants of their attacks, and it becomes necessary to outline some of these variations if a proper diagnosis is to be established and an adequate therapy followed.

Abortive Attacks.—These are common with the migrainous individual. In some sufferers the abortive attack usually begins in the classical manner, with chilliness, partial scotomata, and depression. The patient is apprehensive and waits for the coming ordeal—often lies down, and finds

that, after a half hour or more, the attack passes off, leaving only slight wretchedness or a dull, heavy head with sore eyeballs.

Again, the attacks may consist of the scotomata alone without the vasomotor spasm and chilliness or headache. The depression alone may be severe enough with the other symptoms marked enough to give a clew as to the cause of the mental state.

Variants or Equivalents.—Even more common than the abortive attacks are the variants. The most frequent is that unaccompanied by marked prodromal symptoms. The patient develops a severe hemicrania or a bilateral headache with sore eyeballs, and may or may not have the nausea and vomiting. If the life history of a series of headaches in a migrainous individual be followed, it will be noted that scotomatous attacks vary considerably. Some patients will run a series of migraine attacks, always accompanied by scotomata; then a series without any scotomata at all. Sometimes the attacks with scotomata occur only at night, and the patient awakens with a headache. Possibly he may have dreamed of seeing fire, which is the only incident that points to his having had scotomata.

Many individuals skip the nausea and vomiting in the majority of their attacks. One patient with a life history of over 200 recorded attacks had nausea in about 12, and vomiting in only 1. Yet the other features of the headache were classical.

It is impossible to state percentages of prodromal chilliness or scotomata, unilateral or bilateral involvement, length of time of pain, nausea or vomiting, because each individual's migraine history varies and each attack varies.

With the majority of the migrainous the severity and number of the attacks usually diminish regularly with advancing years; again, in a smaller number (presenile arteriosclerotics), the reverse situation is met with.

Among the rarer migraine equivalents are isolated attacks of nausea and vomiting, isolated paresthesia, attacks of giddiness or vertigo, transitory palsies, intestinal and bladder disturbances, hysterical outbursts, etc.

The short history of one patient who kept notes on 168 attacks will perhaps show some of these facts in another light. These attacks were observed in ten years. More than 75 per cent of them occurred in the first three years. Of these attacks 100 were abortive: chilliness, scotomata, with dulness in the head, but no marked headache. Of the 68 full attacks, one-half were unilateral, the other half bilateral, without scotomata; the rest with marked scotomata and blindness. Throughout the whole series there had been no vomiting; nausea had been occasionally present with anorexia. Two of the attacks were associated with paraphasia. 15 with sensory tactile phenomena, pins and needles in the

fingers, hyperesthesia in lower limbs, chiefly at night, in 6. Blepharospasm was found to be frequent during the attacks.

Another patient had a series of daily attacks for eight months, extending over a period of two years. The attacks were always preceded by chilliness, heaviness, scotomata, and blindness, lasting almost exactly fifteen minutes in each attack. After ten minutes the scotomata would slowly recede, and the headache gradually mount. The greater number of attacks were bilateral. Unilateral attacks were more severe, and accompanied by nausea and anorexia. The bilateral attacks gave a dull, heavy, stupid head, but not the severe pain of the unilateral attacks.

Thus an idea may be gained of the marked variability in the attacks in different individuals, and even in the same individual at various periods.

Therapy.—In the first place, it is essential to separate the specific treatment of the attack from that of the general treatment of the migrainous constitution which renders attacks more liable to occur.

In the treatment of the attack the methods at our disposal are fairly satisfactory. It should be remembered that practically every well-developed attack of migraine shows at least two phases: a primary phase of vasoconstriction, followed by a secondary phase of modified vasodilatation. Therefore remedies which may be utilized for the treatment of an attack are to be chosen with the stage in view.

Thus, it is futile to utilize nitroglycerin when the stage of vascular dilatation has already taken place, and vasocontractors are disastrous in the beginning stages, when the spasm of the vessels is the most prominent part of the picture.

If the patient is seen early enough in the attack, and symptoms of vasoconstriction, such as pale, cold extremities, chilliness, general misery, are present, vasodilators and analgesics should be used. Such vasodilators, however, should be chosen among those whose action is self-limited and more or less fugacious. Nitroglycerin has been found to be one of the most valuable of these, but, as has been remarked, it is only of service in the very early stages, and very frequently is then inefficacious. Of the various analgesics, the anilin derivatives are the most powerful. Acetanilid, antipyrin, pyramidon, and its allies, in doses of from 5 to 10 gr. (0.3 to 0.6 gm.), are useful. Phenacetin and its congeners are less powerful, but in certain respects better adapted to universal use. Occasionally salicylic acid derivatives and other members of the group are of special service. Aspirin is useful here.

It is important in the choice of an analgesic to remember whether its action be complicated by an effect upon the blood; furthermore, the solubility, time necessary for absorption, variations in the chemical formula, the duration of action, and the character of the after-effects; these should all be kept in mind. While one is apt to regard the whole series as acting in the same way, closer scrutiny will show distinct variations

along the lines just indicated. These variations may be utilized to advantage in each case.

It should not be forgotten, furthermore, that a remedy which has proved ideal, either alone or in combination, for a certain number of attacks may soon lose its efficiency. This is generally due to the establishment of a tolerance which prevents this particular combination from being further valuable. One must, therefore, vary the drugs used and also the combinations.

In general, a mixture of two or more analgesics is more efficient than a single one. In the mixture smaller individual doses can be utilized, and a certain amount of therapeutic play can be introduced, which single dosage does not permit. Thus, a mixture containing antipyrin and phenacetin gives the rapid solubility of the one, and its quick action, with the retarded solubility of the other, and its more prolonged action. A small dose of acetanilid can be combined with a larger dose of phenacetin, minimizing the cardiac depressing effects of the former, and at the same time utilizing to the full its powerful analgesic properties, a continuance of which is carried on by the latter. In fact, by a judicious combination of the analgesics with small doses of the bromids or small doses of vasodilators, one usually obtains very prompt and efficient action in the treatment of the early stages of a migrainous headache. So effectual may a carefully thought out combination prove that a headache which has heretofore been regarded with terror ceases to cause any particular apprehension in the mind of the sufferer. This is of very great service in avoiding the use of the opium derivatives, which in previous times was a very potent factor in the production and perpetuation of this drug habit.

The therapeutic indications in the later stages of the attack vary only in so far as the physical signs relative to the cardiovascular system are different. If flushing, intense throbbing, and injected conjunctivæ indicate a vascular hypertension, vasodilators are of little or no value. Caffein is very frequently combined in such cases with the analgesics already mentioned with a certain amount of advantage, but, as a rule, it is not a sufficiently powerful remedy or not prolonged enough in its action to be relied upon. It is very useful in abortive and mild attacks, and particularly valuable in certain toxic forms of migraine, especially those due to alcohol, tobacco, or opium and its allies. Bromids and chloral may be combined with the analgesics, the former particularly for those individuals in whom there is considerable motor excitement, and those in whom hysterical, agitated, emotional reactions are prominent. In a few instances it may be desirable to add codein to the prescription, or even minute doses of morphin. This is particularly true in certain individuals in whom the danger of contracting the morphin habit is either not probable or under circumstances where the contraction of such a habit

would not be so reprehensible, as in certain very old individuals. The patient himself should never be intrusted with morphin derivatives.

In former times aconite, belladonna, cannabis indica, gelsemium, and drugs of related nature were widely employed, but, with the advent of the analgesics already mentioned, the use of these remedies has been much reduced. Only now and then does one find it necessary to administer them. There are individuals, however, who react much better to small doses of aconite or cannabis indica than they do to any of the analgesics, and one should always keep them in the mental eye in the treatment of the more persistent and frequent migrainous attacks.

If it is possible a brisk saline laxative should be administered, and the patient should be undressed and lie down in a darkened room, well covered up and kept warm, after having had a hot bath. Cold, as a rule, is distasteful, although occasionally ice applied to the head has been found to give relief.

A frequent error in the treatment of attacks of migraine is failure to vary the therapeutic procedure. The abortive attacks, violent attacks, and classic attacks not only need different modes of approach, but a different general course of procedure is desirable during an attack.

Treatment of Constitution.—In discussing this feature in another place, I have said that, "although the treatment of the acute attack is fairly satisfactory, it cannot be said that we are as yet in a position completely to prevent attacks. The treatment of the habit, or the constitution, or the liability, or whatever it may be called, is a difficult problem.

"If it be assumed that the hypothesis outlined, that is, that the migraines are mostly vasomotor neuroses, is valid, it is essential to search out all those peripheral causes which may be factors in upsetting the balance of the vascular control held by the vegetative nervous system. A great many migraines have been completely wiped out by the correction of minor peripheral anomalies. Just what proportion of such are cured by special measures is difficult to estimate, as specialists in their respective fields usually claim 100 per cent of cures by this or that procedure, a manifestly illogical attitude. It is certain, however, that a small proportion of patients are cured of migraine by relief from eye-strain, from diseased turbinates, from habitual constipation, from adenoids, from dysmenorrhea, and from a number of other minor yet definite somatic defects.

"Whether such migraines belong to the category of the severer migraines it is difficult to say. On the other hand, one finds that certain migraines resist every form of therapeutic attack, and, in spite of the fact of many years of correction of these minor defects of organization, which are almost universal, they persist. Personal experience indicates that this is the rule rather than the exception, but at the same time it is folly to proceed on the general assumption that the correction of these minor defects is unimportant.

"Inasmuch as the attention of mankind is more or less chronically riveted upon its stomach, it is not unnatural to find this factor loom large in the history of migraine. Nearly all sufferers from it will complain that they are bilious, in which word one recognizes the fad of previous generations, a direct descendant of the days when black bile was considered of so much importance in medicine. If the purely vegetative character of the gastro-intestinal tract be kept in mind, it would seem that only grave disturbances would be provocative of such a constantly recurring type of phenomenon as migraine. At the same time, enough experience seems to have been accumulated to demonstrate, in the minds of the sufferers at least, that they are not entitled to certain gastric indulgences without the recurrence of a migrainous attack.

"Under all circumstances, therefore, it would seem desirable that a fairly common-sense gastro-intestinal hygiene should be carried out. Such a hygiene should not go to the extremes of dietary faddism, but should be founded upon a common-sense recognition of the individual's likes and dislikes and capacities. Certain empirical facts are entitled to considerable recognition, for it is well known that in some individuals carbohydrate intake almost invariably produces a migraine, while in others large quantities of fat provoke a like reaction. Again, in others the use of certain alcoholic drinks induces the same type of reaction.

"This is not the place to prescribe just what measures should be followed out in the correction of the various minor defects which may have some relation to migraine. The point of view of the physician should be that of the inquirer rather than that of the maker of dogmatic assertions regarding these factors. Many false gastropaths are manufactured by the physician in his attempts to carry out a régime of gastro-intestinal hygiene for the relief of a recurring migraine. This suggestive factor is to be avoided, because the results are often worse than the disease.

"If the varying elements mentioned have any real relationship to migraine, it is evident why such a variety of measures will be of help to a few, and why so many more will be worthless for many. Medication between attacks is largely useless, save, naturally, in the symptomatic migraines. General medication, for no definite purpose, but just in hopes that it may do some good, as the giving of iodids, bromids, strychnin, etc., is senseless. If definite factors be found that need correction, and can be so modified by drugs in the required direction, then they will prove useful. Thus iodids will undoubtedly help many presenile arteriosclerotic migraines; bromids are useful for irritable and sleepless conditions which provide a good foundation for the nervous instability that permits an attack; laxative are called for if persistent constipation bears any causal relationship.

"Complicated systems of diet have been devised. Usually such are

more prolific in engendering semi-invalidism than useful for migraine. Here and there a patient derives benefit from a strict dietary régime, but, unless there are real reasons why a patient should not eat red meat, or tomatoes, or other articles, as determined by actual experience, and under repeated experimental trials, in order to eliminate faddists' errors, the patient is better off without a diet card. The reasons sought for are not those contained in many treatises on dietetics, in which medieval notions concerning differences in red meat and white meat, vegetables growing under the ground and those above ground, are foolishly perpetuated. The only satisfactory manner to attack the metabolic problem is to carry out a complete metabolism analysis. Haphazard attacks here and there lead only to premature and insecure judgments.

"Complete formulas for attacking excessive bacterial putrefaction are applicable only when it is proved that such excessive bacterial action exists and has a relation to the migraine. The hypothesis cannot be excluded *ex cathedra,* but it remains unproved for most cases, and of doubtful applicability in a few."

In recent years the analogies between migrainous attacks and the so-called anaphylactic reaction have come into prominence. "Tests" of various foreign proteins have shown a bewildering series of "positive" reactions, from rattle-snake venom to rabbit's-hair scales. Biochemists, bacteriologists and serological students are gathering a host of phenomena of a limited type. Therapy founded upon these observations is at times striking. Milk peptone, for instance, has seemed to help a number of the migrainous individuals, as have in isolated instances almost everything in the gamut of the chemical, serological, bacterial vaccines, etc. Such results have almost always resolved themselves to a unitary group of factors in the history of medicine. When so many different agents can influence a given condition, it has been found that the real therapeutic agent has been the newly engendered "hope" or "wish" for recovery. The "transference," psychologically speaking, has been the important factor. It also works with the mind cures; religion, "pure and impure"; surgical operations, etc; hence the importance of reading these "anaphylactic" reactions in terms of psychological experiments as well as of biochemical ones.

Increasing experience with migraine is tending to show that so-called predisposition to migraine is only one of the many variants of the neurotic constitution. Migraine for these is the somatic scapegoat of the unconscious conflict. Such migraines, therefore, which have defied therapy for years, may be successfully combated by the psychoanalytic mode of approach. The patient thus analyzed, while he may not always rise above his conflict and hence may occasionally need his somatic scapegoat, may get to comprehend wherein he handles his conflicts badly and thus can avoid severe attacks particularly.

TREATMENT OF HEADACHES

Smith Ely Jelliffe

The struggle against headache, considering it as a disease, or as a symptom, has been waged for many years. Cullen, writing in the eighteenth century, remarks that "headache as a disease is obscure, as a symptom difficult. It may be allowed to be generally symptomatic; but I presume it may also be primary; and much confusion has arisen in the attempts to distinguish between them." He then launches into an attack on the system of Sauvages, that doughty nosologist of the eighteenth century, whose species of headaches make a veritable Garden of Allah.

It may not be without value to enter somewhat into Cullen's spirit and see what primary and what secondary or symptomatic headaches were recognized at a time during which American medicine was first being fashioned, and for the most part at Edinburgh, by this great teacher.

Cullen erected from Sauvages' categories: (1) All those pains depending upon typical affections of the external parts, which may occur in other parts of the body, and the seat of which in the head changes neither their nature nor their indications. Thus, the cephalea syphilitica is not a disease different from a pain in the shins, from the same cause. Upon the same grounds he rejects cephalea ab acrimonia, hemicrania ocularis, odontalgica, sinus, purulenta, ab insectis.

2. All those that are manifestly symptomatic, such as the cephalalgia catamenialis, hemorrhoidalis, stomachica, febrilis, pulsatilis, intermittens, gravidarum, inflammatoria, catarrhalis, cephalea arthritica, febricosa, polonica, and hemicrania coryzæ, hemorrhoidalis, nephralgica, and, he adds, I think on the same ground the cephalalgia hysterica, melancholia, hemicrania clavus, and lunatica.

3. The cephalalgia anametropa. The whole species of Sauvages are thus rejected, except three, cephalalgia plethorica, cephalea serosa, and cephalalgia metallica.

This enumeration looks strangely familiar when one glances over a work dealing with headaches, even of the present day.

But, when Cullen leaves criticism to take up description, his reliance upon temperaments, upon the phases of the moon, and the influence of humors causes us to turn to present conceptions, with some misgivings as to how long they, too, will stand the test of further experience.

Sauvages distinguished cephalalgias, cephaleas, and hemicranias—just such a tripartite arrangement may be justified at the present time. It would consider those head pains that are about the head, from the teeth, sinuses, sore muscles, etc.; those pains within the cranial cavity proper, affecting cerebral, or extracerebral, substances, and those pains which

may be classed as migraine, and which for practical purposes it is just as useful to consider as a separate entity, as it has been ever since Aretæus first tried to isolate it from the other headaches, and since Galen gave it its name.

Such a division has value only from the standpoint of convenience, and will be followed here.

Headaches of Extracerebral Nature

Here are to be found a number of affections, with persistent and uncomfortable pains in the head. They are either neuralgias, myalgias, or occupation neuroses (muscular), traumata.

Neuralgias.—The ordinary trigeminus neuralgia, tic douloureux, is not to be considered as a headache; yet frequently, when the supra-orbital branch alone is involved, the diagnosis from other types of headache, particularly migraine, brain tumor, pachymeningitis, hysteria, neurasthenia, eye muscle neuroses may arise. Here one finds the topographical localization sharply marked, when tested by the proper esthesiometers. This localization is either frontal, extending to top of cranium; unilateral, as a rule, the base of the nose, the upper eyelid, the ethmoid, deep within the upper nasal region. There is a characteristic pressure along the nerve trunks, and the tender points at the supra-orbital foramen, and ethmoid point, the parietal tubercle, and the inner angle of the eye. There is also frequently increased sensibility to cold when tested by a cold key or other cool object.

Not infrequently an antecedent influenza, malaria, typhoid, or other infectious disorder is the exciting cause. Constipation has been known to occasion such a trigeminal neuralgia; also intestinal parasites. Leukemia and diabetes are occasional causative factors.

Affections of the middle and inferior branches are omitted here, although it may be pointed out that carious teeth at times cause a chronic temporal headache, often getting worse at night and preventing sleep, whose cause may be unsuspected for some time.

Occipital Neuralgias.—These, when occurring in the branches of the occipitalis major, minor, or auricularis magnus (Hasse), often are to be separated from occipital intracerebral affections, such as caries of the vertebræ, cervical cord tumors, and from the frequent so-called neurasthenic headache.

These neuralgias are almost invariably bilateral, and the Valleix points may be found along the cervical outlets. When sharp in character, their neuralgic nature is obvious, but they are frequently dull, are increased, or brought about by movements of the head. The pains often reach the vertex, and are significant of this neuralgic type when coursing along the shoulders, or down into the arms.

The therapy is by local application of heat, local rubefacients, mustard plasters, cantharides, menthol, etc., special measures.

Naturally foreign bodies, sclerotic areas, wound scar tissues, etc., should be removed when they press upon the nerve terminals. Occa-

Fig. 1.—The General Diagnostic Indications to Be Derived from the Seat of Pain in the Head and Face. (Butler.)

sionally one has to deal with a syphilitic neuritis of these nerves. The Wassermann reaction should be utilized in making a diagnosis. Malarial cases need quinin. Such cases have regularly recurring pains, and the drug should be given in doses of from 15 to 20 gr. five to six hours before the expected attack. Iron salts, calcium, and arsenic are indicated in the anemic neuralgias.

Electricity has special indications in these more obstinate neuralgic

headaches, although less frequently needed in the supra-orbital type than in true tic douloureux. Here the rapidly alternating current of Leduc is of value in five to ten-minute sittings, once or twice a week. In the milder cases the galvanic stream is helpful. In either case the anode is placed over the sensitive pressure point, and a stream of not over 1 to 1.5 ma. allowed to pass for from ten to fifteen minutes. Faradic penciling of the tender skin areas for from five to ten minutes should then follow.

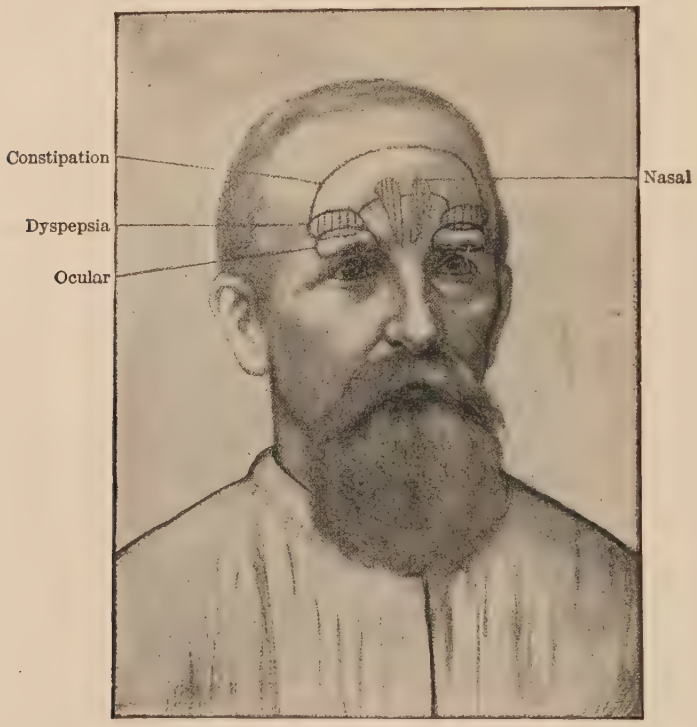

Fig. 2.—The Causes of Localized Headache, According to the Exact Site of the Pain. (Butler.)

The local application of methyl chlorids will cure some of these supra-orbital neuralgias.

Of the antineuralgics the antipyrin, phenetidin, and salicyl derivatives are the most useful. Antipyrin, salipyrin, aspirin, phenacetin, acetanilid, pyramidon—these are among the most useful, singly or in combination, according to other etiological conditions. Acetanilid is to be administered never in doses over 5 gr. (0.3 gm.) as a first dose to an unknown adult. Although all of these derivatives are closely related pharmacologically, as well as chemically, it will be found that individual idiosyncrasies exist that make it important to try one after another in order to find the most valuable in a minimum dose, either singly or in

combination. Frequent changes are advisable, and the physician is lax in his obligations to his calling if a drug habitué results.

The use of gelsemium, gelsemin, aconite, aconitin, atropin, cannabis may at times be required, but only as surrogates to other remedial measures.

The question of massage is difficult to pronounce upon. One will frequently find patients who have found relief from deep massage, special massage, osteopathic massage, etc., after the family physician has failed. It is highly probable that such cures are the result of encouragement, of reëducation, of suggestion, and some humbug; not an uncommon mixture in all prescriptions. But one does not refuse to use a palatable vehicle to carry properly a combination of efficient remedies.

The treatment of the more frank neuralgias by injection of alcohol and by surgical procedures is discussed elsewhere.

Cervical Sympathetic Headaches.—These may be neuralgic in nature, but more frequently alter the statics of blood-pressure, and more properly belong to the intracranial causes.

Reflex Tenderness of the Scalp.—Empirically it has been recognized for years that certain visceral disorders are frequently—almost invariably—associated with reflex pains or tenderness in the scalp. These reflex pains are very often complained of as headache. Hilton, Dana, McKenzie, and particularly Head have studied these reflex disturbances, and have shown, for many at least, that these skin areas are in anatomical relation, through collaterals in the cerebrospinal axis, with the main nervous trunks, coming from definite organs. When these organs are diseased or functionally disturbed, reflex pains appear in the scalp areas referred to.

The intensity of the hyperesthesia in these areas varies widely, and may bear in neurotic types some proportional ratio to the intensity of the visceral disturbance. These pains may be severe.

On examining the skin areas of the head with the rounded glass head of a sharp pin, with the point, with von Frey's hairs, or other esthesiometer, one can map out these areas, which do not in general conform to any strict nerve topography. They are usually circumscribed and bilateral.

The sensations complained of are dull aches, casquelike bands, sore spots, very tender areas to touch, with persistent dull and annoying ache.

The accompanying figures illustrate the main localizations.

The therapy is twofold. Local application of counterirritation helps the tender spots, as well as the visceral disorders; adequate treatment of the visceral disorder relieves the topalgias, or localized pains.

Neurotic Muscle Headaches.—This group of local headaches is very important and little understood. I purpose to include here a number of headaches which really are the result of a continuous muscle activity. This is not a *conscious* activity in the sense of a continuous series of mus-

cular acts, but is rather the result of a series of partly automatic motor adjustments, usually set in operation by reason of some anomaly in the chief receptors of the head region, the eyes, ears, skin, etc. Among them are the eye-strains, the ear-strains, the neck-strains, all conditioned by some defect in the symmetrical balancing of other muscles of the body.

These pains are usually in the frontal and occipital areas, and are often extremely persistent.

So far as statistics now lead us, the eye headaches are the commonest; they are located either frontally, when the chief irregularities of tension, with, therefore, a compensatory overstrain to correct, are in the eye muscles themselves, emmetropias, asthenopias, astigmatisms, hypermetropias. After years of compensatory overactivity of certain muscles, a real occupation neurosis may set in in the overstrained muscle group, showing itself in pressure over the eyes, frontal headache, and at times various other spasmodic or neuralgic phenomena.

Another group concerns the entire position of the head, which not infrequently is held asymmetrically to compensate for unsymmetrical picture formation in the eyes. Here there develops, very frequently, an occupation neurosis in the chief muscles that support the head, with stiffness in the neck, and deep-seated, sometimes parietal, headache.

Desk workers, literary workers particularly, are victims of this type of headache.

Frontal headaches of a related nature are found in many individuals whose corrugators are constantly contracted—photophobics.

Oncoming deafness, asymmetries of hearing, possibly of smell, may account for certain headaches of this type. And, furthermore, it is certain that asymmetries of posture, disproportion in the body equilibrium, can produce similar headaches, chiefly occipital. Certain experiences in department stores, factories, etc., have demonstrated the tendency for certain positions to develop this variety of headache. When the nature of the work was modified, so as to permit greater freedom, and a more evenly balanced activity, right and left, forward and backward, the resultant freedom from headaches has been remarkable. The backaches and headaches of factory hands, seamstresses, shop girls, and others working in positions in which the factor of asymmetrically balanced muscular activity is constant can be in large part explained.

Not all of these workers have such disorders, but they are frequent. Neither is it true that all of the headaches of the nature described are due to these asymmetries of muscular activity which entails constant stress upon one set of muscles. For one to claim them all to be due to eye-strain implies a mental squint which, if sufficiently long operative, will bring about an occupation neurosis of the logical faculty—as a mild affection—a faddist of the more intense grades, a crank—in superlative

terms, a victim of a delusion. Unfortunately, all these grades exist; the charlatan, a fourth, fattens on the teachings of the other three.

The treatment of these headaches is often very brilliant; by proper glasses, by proper adjustment of gait and position, and by correct teachings, exercises, and placements in the various occupations. Each situation must be met by a complete analysis of the motor habits of the individual and their correction. In reaching a judicial estimation of any cure, careful consideration must be given to the factor of faith, which is a very subtle and important element in all therapeutics.

Acute, subacute, and chronic inflammations of the eye structures occasionally give rise to severe headaches. These may follow conjunctivitis, iritis, keratitis, and particularly glaucoma. The latter is of special importance in its differentiations from neuralgias.

The therapeutics are specific for the disorder in question.

Nasal and Frontal Sinus Headaches (*see Fig. 2, previously referred to*).—The trigeminus is often markedly affected in nasal disorders, either mechanically or reflexly. Swelling of the nasal mucous membrane results in the well-known heavy feeling in the head due to a nasal catarrhal inflammation. Acute or chronic inflammation of the frontal and accessory sinuses almost invariably produces headache. In acute frontal sinus disturbance there is a distinct frontal headache, sharply localized between the eyebrows and often very painful upon pressure, sometimes even to touch. Pressure over the malar bones may be painful in catarrhal inflammation of the accessory sinuses. Transillumination reveals the swollen membranes, or the filled sinuses. In purulent cases there is frequently an extension of the pain area, and pulsation is not uncommonly felt.

Polyps in the nose are responsible for some reflex headaches. Obstructions which cause a disturbance of the circulation cause headaches in the frontal areas.

In the nasal sinus cases there are usually accessory signs, which require specialistic examination.

The therapy must vary according to the cause. In the acute catarrhal cases small doses of atropin, combined with aconite, with local astringent and emollient sprays, are often sufficient to bring about a cure. In the influenzal types salicylates can be added to advantage. Surgical measures are necessary when there is pus; polyps or other obstructions are to be removed, care being exercised to avoid ethmoid infections.

Ear Disease Headaches.—These are often combined with earaches or with mastoid pains. The pain is parietal, often widespreading, and is usually increased by jaw movements. Extension to the mastoid, with pain on pressure, is always to be watched with care, since brain abscess often shows itself by such signs, following middle ear or labyrinth disease.

Labyrinthine disease gives rise to headaches of the same nature as

those encountered in middle-ear disease. In addition one encounters labyrinthine nystagmus—rotatory, horizontal—vertigoes, cerebellar gait, and other symptoms of disturbance of space coördination. An exhaustive application of the Barany tests is needed for the purposes of diagnosis (see Vertigo).

The treatment is usually palliative when the disorder is purely serous or catarrhal; aconite, belladonna, heat, or surgical, when there is pus.

Bone and Periosteal Headaches.—These are not frequent. They follow trauma, or are due to caries or gummata. Their localization, tenderness to pressure, and palpation features are usually sufficient to afford a clew to the diagnosis.

Here the treatment is etiological.

Myositis or Indurative Headaches.—This is a very distinct form of headache, not uncommon, frequently mistaken for migraine, often of a subacute or chronic nature, and readily cured by appropriate methods, although at times requiring a comparatively long period. Swedish investigators particularly have studied it, and it has been of late much investigated by Cornelius, Peritz, and Edinger, the former two allying the headache with neurasthenia, for which there is no proof.

I speak of these as myositis headaches. Edinger calls them indurative headache, because careful palpation of the muscles of the head, particularly at the tendinous aponeuroses of origin or insertion, reveals slight thickenings or nodular hardenings, which are often excessively painful to the touch, and in which tenderness is present, not only during the height of an attack of pain, as may be seen in migraine, for instance, but remains permanent.

The localization of the more important of these painful points is seen in the accompanying diagram.

These correspond, in part, to the Valleix points, at one time much discussed, and now frequently forgotten.

This form of headache is very frequent in women. At times it is extremely severe, almost resembling an attack of meningitis, with agonizing pains in the occipital region and nape of the neck. At times there is pronounced nausea from the agonizing pain. There is no elevation of temperature. On palpation, the forehead, parietal and temporal regions are rarely hyperesthetic, as is so frequently the case in true migraine. At the insertions of the muscles at the back of the head there are excessively tender points, and at times one finds nodular swellings in the belly of the muscle, or at its insertion, sometimes multiple, which by deep massage may be in part dissipated.

In the chronic cases the headaches are apt to be persistent, occipital, with periods of remission and acute exacerbation. In this period of increase the attack is often like a migraine, may be one-sided, is more often occipital, but may be frontal and occipital, but there are rarely any vaso-

motor phenomena, auras, etc. Moreover, the pain frequently radiates into the deltoid, which is not common in true migraine.

One feature of these headaches which should lead one to suspect the diagnosis is that other muscle groups are often also involved with pains, stiffness, and diminished activity; similar painful nodules and points are found in them as well.

Exposure to cold seems to bear some etiological relationship to the affection; hence, it is frequently spoken of as rheumatic, which is naturally to be interpreted in the lay sense. Some have expressed the idea of swollen sympathetics, neuralgias, and others speak of uric acid deposits, results of auto-intoxication. Quack masseurs often speak of these as chalky deposits, which they can rub away, but the exact pathology is uncertain. It is highly probable they are vegetative nervous disorders of the nature of tissue edemas. The treatment, then, is primarily by massage, which should be begun shortly after the acute period has passed.

Fig. 3.—Location of Indurative Muscle Headaches. (Edinger.)

The patient should have a laxative, 15 gr. of aspirin, or other salicylate preparation, hot cataplasma, hot bath, and then the sore muscles should be massaged toward the body, usually with the thumb, and at first gently, but later more and more firmly. The nerve trunks are at first gently massaged, but after the second or third treatment deep, strong pressure may be applied with a vibratory motion. A mechanical vibrator may be used later to advantage.

A séance should begin with five minutes, later extending it to fifteen, and it usually requires biweekly treatments for from two to six weeks.

General measures—tonics, etc.—may be required in some patients who have become below par. Warm climates, free from sudden changes, are helpful, but the best treatment is by means of the massage mentioned.

The osteopaths have helped many of these patients, because the nature

of the malady has been forgotten by most doctors of the "scientific" era. The osteopathic ideas of etiology, however, are absurd. The good results come from deep massage of the nodules. Valleix and his contemporaries described the headaches many years ago.

Headaches Due to Intracranial and Extracerebral Causes

Three large groups may be distinguished:

1. Those due to meningeal disorder or irritation.
2. Those due to new growths, causing pressure within and without.
3. Those due to disturbances of circulation, or disposition of the blood, or of the cerebrospinal fluid.

Meningeal Headaches.—The headaches of acute meningeal disorder need not be considered *in extenso* in this place. In cerebrospinal meningitis, tuberculous meningitis, acute meningitis, from extension of pyogenic foci—traumata, middle ear, or sinus disease—the headache is very profound, and occurs early in the disease, before other symptoms indicate the real underlying factors. Certain patients with poliomyelitis or encephalitis complain first of a headache.

These headaches are usually both frontal and occipital. In tuberculous meningitis they are in the neck and the occiput. Other symptoms, however, fever, stupor, stiffness of the neck, convulsions, paresis, etc., soon remove these headaches from the category of those here to be more specifically dealt with.

It is to those headaches due to a subacute or chronic disorder involving the meninges, and which appear prominently and usually alone in the symptom picture, before development of other symptoms, that particular attention will be directed at this time. These are the headaches of pachymeningitis hæmorrhagica interna, pachymeningitis cervicales hypertrophica, serous meningitis, syphilitic meningitis.

In hemorrhagic pachymeningitis the only symptoms may be a localized, diffuse, or persistent headache, with possibly some eye changes, swollen disk, or choked disk. The diagnosis may be impossible without skull puncture, and is only suggestive if the common exciting causes may have preceded, alcoholism, trauma, general paresis, or senile dementia (Blackburn).

Lumbar puncture has been of value in some traumatic internal hematomata.

Serous meningitis, which frequently is secondary to a purulent meningitis, frontal or accessory sinus disease, labyrinthitis, give rise to severe headaches, which resemble those of a brain tumor, brain abscess. Choked disk is an early sign. The headache frequently shows improvement on

operation on the ear, mastoid, nasal sinuses, and is often relieved by lumbar puncture.

Syphilitic meningitis of the convexity or of the base occasions severe persistent headache, which may come on early or late after infection. In the former case the pain is usually persistent and violent, often definitely localizable on cranial percussion, with attendant skin tenderness. As a rule, general pressure symptoms—choked disk, nausea, vomiting—are absent from the tendency of the disorder to spread superficially. As a rule, cerebral signs appear later, irritative epileptic phenomena, increased tendon reflexes, sensory signs, tingling numbness, aphasias, etc., occasionally one or more appear early. A widespreading, superficial involvement is very significant of syphilitic meningitis, especially when combined with some apathy, or occasional confusion. Pupillary anomalies are not infrequent—slight irregularities, stiffness to light.

The blood Wassermann is usually positive, the cerebrospinal Wassermann may be negative, and Phase I Nonne not yet definitely known; the cell count is apt to be variable but usually some lymphocytosis is present.

In syphilitic meningitis of the base headache is practically always present. It is very violent, occipital, and not infrequently felt deep behind the eyes. The tenderness to percussion is not infrequently above the eyes. In contrast to meningitis of the convexity optic nerve changes are more frequent. Psychotic outbreaks are not infrequent with a paranoid coloring—at times manic, again depressed. Fever is only very occasionally present; subnormal temperature is not unusual. Polyuria and polydipsia are frequent, and the cranial nerves are frequently involved very irregularly; the olfactory among the others, indicating frontal lobe localization.

The serological changes are similar to those just noted. The treatment is by arsphenamin, or by inunctions of mercury.

Tuberculous Meningitis.—Here the headache is an early sign. The disorder occurs particularly in young, poorly nourished children or in adults with other tuberculous lesions. In children there is usually a history of an antecedent restlessness; the children are out of sorts; they eat badly, are peevish and irritable, cross and surly, and their sleep is broken. The headache is usually intermittent at first, fugacious, but later becomes persistent, and is marked by ups and downs in its severity. There frequently are also reflex pains in the abdomen and in the chest. Emaciation is apt to be progressive. This headache may persist for months, with slight afternoon and evening rise in temperature, before the more pronounced symptoms of meningeal irritation occur. In others the development of the more sinister symptoms is much more rapid, within a week or month. These are severe headache, stupor, delirium or coma, and convulsions. These children lie in bed in a semidoze or stupor, with frequent crying and grimacing, marked restlessness, throwing themselves about.

Older patients show a dreamy delirium, with constant headache. Other signs of tuberculous meningitis are to be found in the appropriate chapter. After the prodromal headache stage is passed, the interests of this chapter cease.

There is no treatment for the headache per se. The diagnosis is to be made and the treatment of the tuberculosis is to be begun as early as possible, but the results are not encouraging.

Some rare forms of chronic meningitis, non-tuberculous, non-syphilitic, and of obscure etiology, give rise to severe persistent headaches often associated with choked disk, vomiting, and indications of a hydrocephalus. They are extremely rare. Oppenheim has discussed them in a special section on Chronic Meningitis.

Intracerebral Headaches

Here may be grouped the great number of headaches due to chronic encephalitis of pyogenic or toxic origin, to brain abscess, brain tumor, or arteriosclerosis.

Here the pain may be due to meningeal irritation, as in the meningoencephalitis of syphilis, of paresis, of multiple sclerosis, of alcoholism, lead, etc., or the pain is purely a pressure phenomenon due to a new growth, tumor, abscess, etc. The pains of arteriosclerosis, softening, etc., are certainly not explained on the hypothesis that the meninges alone are capable of receiving painful impressions. Since central sensory pains are known for the extremities in thalamus lesions, it is probable that there are central sensory pains for the fifth and other sensory cranial nerves giving rise to deep or superficial headaches. Their central representation has not as yet been satisfactorily cleared up (Müller).

Brain Tumor.—No attempt is here made to distinguish the forms. Glioma, endothelioma, tuberculoma, gummata, abscess, large pituitary, teratoma, angioma, etc., may all give rise to headache, after they have reached a size sufficiently large to exert pressure. Headache is almost universal in brain tumors, yet it should not be forgotten that it may lag behind other symptoms which definitely point to tumor, or may be absent almost throughout the entire course of the growth. Hard compact tumors are apt to induce headache earlier, and it is usually more persistent, whereas softer tumors, such as infiltrating gliomata, cysts, myxomata, chordomata, by reason of their softer consistency, permit of much molding or adjusting, and pressure symptoms are usually delayed.

The headache of brain tumors is usually very severe and is persistent. It rarely intermits, save, perhaps, in the earlier stages, and even in the free intervals a certain heaviness is usually left. It usually continues during sleep, and is rendered more acute by jars and by sudden movements. Any act that tends to increase the cerebral tension augments the

headache: defecation, coughing, sneezing, taking of alcohol, smoking, etc.

The localization varies considerably; usually more or less general or universal, it may be (though rarely) sharply restricted to the general site of the new growth, frontal, parietal, occipital. It may also be found that widespread, heavy headache may be combined with a local, sharply defined one. To trust to the site of the pain as a certain localizing sign is precarious. Many pontine, and especially cerebellar, tumors give marked frontal headaches. Again, other cerebellar growths show exquisite occipital pains and painful percussion points.

Percussion of the head should never be neglected in studying brain tumors with the view to their localization. It is of general rather than special localizing value. Abscess and cysts frequently show very sharp local percussion tenderness.

From headache or from local tenderness alone a diagnosis of new growth of the brain should not be made. To it the symptoms of choked disk or optic nerve changes should be added. Here again both pain and nerve changes may be absent, and still there may be tumor—this is not infrequently seen in infiltrating gliomata, and occasionally in frontal lobe tumors. Temporosphenoidal tumors run their course without much headache at times.

The general signs of brain tumor, nausea, vomiting, motor pareses, sensory anomalies, psychical anomalies, these render the diagnosis certain, and often permit of accurate localization.

In cerebral abscess, in addition to the pain, which is often very intense, the antecedent history is all-important. Given a trauma, a suppurative middle ear affection, a suppurative frontal sinus disease, when one finds a persistent, intense pain developing, with temperature elevation, a brain abscess is probably commencing. This may or may not be accurately localized by percussion.

The therapy is exclusively surgical, save in the case of a gumma, where an antisyphilitic treatment is indicated in the presence of a positive Wassermann of the blood, a positive Phase I Nonne, and possibly a leukocytosis in the cerebrospinal fluid, which latter may be negative to the Wassermann tests.

Headache and choked disk, it should be borne in mind, may be present in multiple neuritis, in lead encephalopathies, in nephritis, in chlorosis, and these should be ruled out in the diagnosis of a tumor headache.

Hydrocephalus.—An increase of cerebrospinal fluid may result from a variety of causes, from inflammation of the ependyma, to blocking of the aqueduct, or to pressure on the veins of Galen. Such an increase of fluid within the ventricles, independent of the numerous causes, will cause intense headaches. With congenital hydrocephalus we have nothing to do.

The headaches of acquired hydrocephalus are usually very intense,

but are subject to great fluctuation in intensity. The irregularity of remission is often strikingly characteristic. With the headache are found the general symptoms of intracerebral pressure, choked disks, nausea and vomiting, hebetude, comas, diminished attention, and, finally, various paralyses. Swelling of the head, exophthalmos, may be present. The percussion note is at times modified.

Treatment.—As far as possible, the original cause should be ascertained. Surgical removal of a tumor or a cyst, antisphilitic treatment of a syphilitic ependymitis, tapping the ventricles, lumbar puncture are all to be tried, in addition to hydrotherapy, hot pack to the head, and other agents calculated to lessen serous exudation.

The lumbar puncture may be repeated several times, or the trocar may be allowed to remain, permitting a few cubic centimeters of the cerebrospinal fluid to escape every minute or so.

Headache as Symptomatic of Toxemias or General Disease

Toxemias.—Chronic lead poisoning, alcoholic poisoning, nicotin, arsenic, iodin, iodoform, copper, opium, carbon disulphid, and several other toxic substances cause acute or chronic headaches. In the lead encephalopathies, often complicated by severe nephritis, the headache is usually diffuse; in the milder cases described as a pressure or heavy feeling, resembling the neurasthenic types of headache; in the more severe forms the headache is extreme, and is associated with signs of mental hebetude, at times convulsive movements. The gum line, albumin, changes in blood-vessels, the colic, the basophile granulations in the blood, neuritis signs, etc., all help in the diagnosis.

Here the therapy is directed toward prevention for lead workers. Greater cleanliness is the first requisite. In lead mines special masks must be worn. In those in which the lead gains access through the stomach the use of very dilute sulphuric acid—which should also be free from lead—is recommended. I have had no personal experience with this remedy. Hydrotherapy is essential to aid elimination, and a fat, protein, and iron-rich diet is advisable for the reconstruction of the blood-cells, the nutrition of the altered nerve cells.

In chronic nicotin poisoning, particularly in excessive cigarette smoking, occipital headaches are frequent. These headaches are frequently associated with pressure signs, and like other toxic headaches result from neural and blood-pressure changes.

Acute alcoholic indulgence, acute morphinism, are associated with severe frontal headaches. In the former an intense hyperesthesia of the scalp is very characteristic. In the latter a basal occipital headache is not infrequent, associated with much itching of the skin of the body.

The therapeutic relief is quite obvious, if the toxic materials are still operative; prompt emesis and catharsis should be carried out. Washing the stomach is very grateful. Coffee or caffein is very beneficial in combination with antipyrin or phenacetin and elixir of sodium bromid.

Nephritic Headaches.—These are conditioned in part by toxic factors, in part by circulatory alterations within the brain. They are particularly frequent in chronic nephritis with contracted kidneys.

The pains are usually heavy, rather than sharp; pressure or heaviness is complained of; more rarely acute pain in the forehead.

The presence of albumin in the urine, of diminished urea secretion, of high blood-pressure, with other signs of uremic poisoning, of retinitis, point to the diagnosis.

The treatment is that for this form of nephritis, which is discussed elsewhere.

Diabetic Headaches.—These usually show as diffuse pressures, with heaviness, with not infrequently irregular neuralgias, or neuritides. The trigeminal is often involved; often there is a neuritis of the arms. Preceding a diabetic coma there is usually an increasingly severe headache.

Sugar in the urine, high specific gravity, thirst, itching skin, and other symptoms establish the diagnosis.

Leukemia.—Heavy headaches are present in this blood disorder. It is frequently associated with vertigo, fainting, and other signs of anemia. Arsenic therapy should be tried.

Anemia and Chlorosis.—These give rise often to intense headaches, especially in adolescent girls. They are frequently associated with trigeminal neuralgias. They are seen in the poorly nourished, overworked factory hands, and all who have the habit of taking the various headache remedies, especially those containing acetanilid, which of itself, in doses over 10 to 15 gr., has a disastrous action on the iron-oxygen interactions in the red blood-cells, thus introducing diminished functional capacity to the already reduced iron content of the cell.

The cause for anemic headaches is not as yet clear, although various hypotheses are advanced, chief of which is the positing of an unknown toxic action.

The headaches are often intensely severe, are continuous, and involve the entire head.

The diagnosis is established chiefly by the color of the patients, their modified condition, and is corroborated by the blood findings.

The therapy is for the underlying condition, which is discussed elsewhere.

Gastro-intestinal Headache.—These are frequently of the reflex type already discussed. The headache of an empty and hungry stomach is an example. Various forms of indigestion are similarly accompanied by dull or severe headaches, chiefly frontal.

In hyperchlorhydria severe headache is not infrequent, but more often one finds a sense of malaise and heaviness. It is seen in very typical fashion in the mildly seasick, where hyperchlorhydria and heaviness in the head are frequent.

Many migraine attacks seem to have definite gastro-intestinal disturbances as forerunners.

The headache of constipation is classic. It is most frequently a sense of pressure, often relieved by a free stool.

Auto-intoxication is not a satisfactory answer to the question—Why? Neither can one claim them all to be reflex. Possibly pressure anomalies are at work, in which case the filled venous channels of the abdomen are responsible for the disturbed cerebral circulation. The passage of a large stool cannot cause instant relief from any toxic factor, whereas such a passage has an obvious effect upon the circulation and the vegetative circulatory mechanisms of the splanchnic area.

The therapy here is obvious, but, as the treatment of constipation is considered in another section of this work, those pages should be consulted.

The headaches of hepatitis, cholangitis, gastroduodenitis are due to infection, to toxemia, and to fever.

Postinfectious Headaches.—Headache is often an obstinate after-symptom of many infectious diseases. This is particularly true for influenza. Postinfluenzal headaches are often of the greatest intensity, and when combined with overwork the resulting disability may be extreme.

The headache is usually occipital. It is low in grade, rarely advancing to the sharp ache of a neuralgia. It comes on with the slightest effort that the patient makes to do any mental work. Frequently such patients cannot read a line in the newspaper without evoking a headache which completely disables them. There may be no other symptoms, and the patient does not suffer during sleep, or when walking. Such headaches may persist for weeks, even months.

Therapy.—Massage of the back of the head, hot baths, frequent feeding, and a two or more weeks' Weir Mitchell rest cure are particularly valuable. At times the patient cannot rest in bed, in which case graduated walks, riding, automobiling are useful. Any tense directive effort causes the headache to reappear.

Free catharsis is desirable. Combinations of bromids and analgesics are at times necessary. Opium is to be avoided.

Syphilitic Headache.—Cerebrospinal syphilis is usually associated with headache, especially when it is at all active. In addition to the other signs of this disorder, the advancing neurasthenia, the pupillary, serological, and cytological changes, etc., which may precede for many months, even years, more obvious neurological symptoms, one finds headache.

Even in the period of eruption there may be marked headache. These early headaches are usually occipital or hemicranic; they show a similar tendency to those of the later period, in that they vary in intensity, increasing toward night. During the day the pains disappear almost entirely.

In the later phases of syphilis, particularly in the cerebrospinal types, the headache is more variable. The nightly exacerbations are present, but are not so conspicuous. Syphilitic basilar meningitis has already been noted.

In general paresis the headache is very variable. Many patients complain of a disagreeable pressure in the head, others of pain—but this is usually only in the beginning of the disorder. In the later phases paretics rarely complain of headaches, save at times following a convulsive seizure. The treatment is to be directed against the treponema.

Psychogenic and Psychotic Headaches

Under this head will be classed a large group of headaches. There are those headaches which certain patients develop, either as an habitual selfish reaction, to avoid exertion, or in response to interference with one's individual plans. Such headaches, frequently indulged in, have a tendency to recur at intervals not appropriate to the individual's plans, and contribute not only to enhance personal selfishness, but lack of resistance to more fundamental causes for somatic headache.

Another large group of headaches is due to the contraction of drug or liquor habits. The patient develops a headache which demands its relief by means of morphin, alcohol, or other stimulant. There is a great deal of this type of headache among the well-to-do classes, as well as in the world of the demimondaine. "Really, my dear, I must lie down, I have such a headache," is the usual formula which precedes dishabille, a dose of drug or whisky, an erotic novel, and a lazy self-indulgent hour or so. The treatment of this type of headache, as a headache, is only attempted by the medical sycophant.

With the almost universal "headache excuse" habit—the usual plaint of all autobiographies, the theme of conversation in the cars, the theater or shopping counter—we shall not deal. Few people go through life without some headache, probably no one has so much as he wishes to think he has. The headache excuse habit is pernicious; as a symptom of general dishonesty it is as revealing; as an efficient excuse it is worn out.

Many so-called neurasthenic headaches are nothing but habit excuse headaches. We slop in our energy, our work, or our efficiency, and we rig up a headache to explain it. Mankind is continually excusing itself for its deficiencies, and the headache is the easiest way out of it, and, as everybody uses the same artifice, it is useless to protest.

Neurasthenic Headache.—Neurasthenic headaches per se do exist, but they are rarely found without other concomitant signs. Just as headache with stiff pupils, positive Wassermann, positive globulin and cell count in the cerebrospinal fluid means cerebrospinal syphilis, a headache in order to be neurasthenic must show definite fatigue factors: characteristic ergograph tracings in the muscular sphere, defects in attention, loss of power in addition experiments, and a whole series of psychological reactions, which the work of laboratory workers has established. A diagnosis of neurasthenia should be founded on these alone, and every organic cause should be rigidly excluded. Simon-pure neurasthenic headaches are comparatively rare.

When found, it can be learned by a proper mental analysis that emotional factors play a larger part in the neurasthenic reaction than does so-called overwork. Worry over financial matters, the conduct of children, love affairs, unalterable and grinding bitternesses, economic sordidness, these are a few of the innumerable emotional factors that bulk large in the production of a neurasthenic headache. Unsatisfied phantasies often combined with concrete masturbatory activities are very widely found in true neurasthenic and in anxiety neurosis headaches. It must be remembered that genital masturbation is not the only type of self-worship and self-indulgence. Every sensory area is capable of masturbatory activities.

The chief feature in true neurasthenic headaches, but which is not by any means sufficiently definite to permit a diagnosis, is the sense of weight in the head. The pain is rarely acute, the head feels heavy; the pressure is usually occipital, but may be frontal or anywhere in the head. It may change from place to place. There are a number of descriptive phrases—iron bands about the head, the weight of a helmet, etc.—but such characterizations have been seen in patients with lead poisoning, nephritis, occupation neuroses, brain tumor, etc. An uncomfortable sense of dizziness or giddiness often seems to pervade the head; the patient says he cannot think—everything is empty. This headache is usually persistent. It is often worse in the morning, clears up in the afternoon or evening, and is made worse more particularly by much talking, writing, or effort requiring much concentration. Emotional excitement may drive it away, but it returns redoubled in intensity and area of extension.

Irritability is a frequent general sign, and the petty pin pricks of life are borne with little equanimity. Slight exhibitions of temper—often generously called temperament—increase the discomfort.

Hypochondriacal depression is frequently present. Such a depression must be sharply differentiated from that of the cyclothymic or mild manic-depressive psychosis, with its frequently appearing headache complaint.

Treatment.—This is found in the chapter on Neurasthenia in General. From the present writer's viewpoint, the general principles of Dubois' reëducation method are of the greatest value in the treatment of

neurasthenic headaches. Psychoanalysis is rarely needed in the pure types.

Hysterical Headaches.—Pure hysterical headaches in the sense of head pain conversions in individuals of the hysterical character are here referred to—not the thousand and one pseudohysterical headaches which have already been designated the "headache excuse habit."

The true types are not frequent. There is one form that is almost characteristic. This is the hysterical clavus, or boring pain, usually sharply localized, as though a nail were being driven through the skull.

The features of hysterical headaches and their treatment are here discussed in the chapters on Hysteria and on Psychotherapy.

Cyclothymia.—In the mild attacks of manic-depressive psychosis one finds a characteristic picture that should never be overlooked, since suicide may take place, much to the chagrin of the attending physician.

These patients are mildly depressed; they refuse to permit their mental attitude to appear too frankly, for fear of being considered mentally disturbed, and therefore enhance their physical distresses. They frequently suffer from gastro-intestinal disturbances, and often complain continuously of pain in the head.

Careful scrutiny shows that many of these patients are rather slow in their reactions; they talk and move with less freedom than is their usual wont, explaining it by the heavy feelings in their head and their difficulty in thinking. Intelligence tests—Bourdon, addition, etc.—show not the characteristic neurasthenic curves, but those of retardation. Further anamnestic search will probably bring out other "neurasthenic" attacks; perhaps some periods of busy activity and excessive well-being; not infrequently a frank outburst of excitement of varying duration, or a frank depression—"melancholia over a love affair," "financial worry," etc. The family history may show similar periodic disturbances of a mild or severe grade.

These are cyclothymic attacks, and in the depressed stage the treatment calls for careful supervision. Many of these patients commit suicide. The diagnosis of "neurasthenia" has been a fatal blunder.

Dementia Præcox.—Hypochondriacal headachy ideas are very frequent in the beginning of many dementia præcox attacks. They also masquerade under the term neurasthenia, more frequently under that more modern symbol, psychasthenia. Here one finds the characteristic beginnings of the habit disorganizations, so well emphasized by Meyer, the shut-in personalities described by Hoch, the predementia features of useless day-dreaming and half-baked philosophizing written upon by Jelliffe and others. With the frank outbreak of the psychosis, treatment is possibly ineffectual. It should have begun in the so-called neurasthenic or psychasthenic phases. Psychoanalysis, most carefully conducted, alone attempts any real "getting at" these patients.

TREATMENT OF VERTIGO

Smith Ely Jelliffe

What is to be understood by the term "vertigo"? Giddiness, dizziness, and vertigo are used as synonymous terms, and, lacking more precise definition, will remain so in the common speech. What one patient complains of as giddiness, another describes as dizziness, and a third as vertigo.

Dizziness in its early origin refers to dulness, to confusion. Its early Anglo-Saxon form is *dysig; dösig* in the Danish, *tusic* in high German; it was used to include a number of conditions of altered consciousness, such as the dull, confused states in toxic deliria, and in other psychoses, but its original etymological significance has been much modified in more recent years. Giddiness is even a better term; the Anglo-Saxon meant by it a singing, with dancing or whirling, and therefore it more nearly represents or expresses the chief features involved in the true vertigoes, which word itself, derived from the Latin—*verto,* I reel, I turn—is almost an exact description of the phenomenon under consideration. Nominally included here as a neurosis, the present discussion deals with all the usual types of vertigoes.

Vertigo, as here understood, is a clinical syndrome, occasioned by a number of peripheral or central disturbances, each leading, however, to a disturbance in consciousness of the *sense of static orientation in space.*

This loss of static sense orientation may be an isolated phenomenon, in which case one can speak of a pure vertigo; but it is apt to be associated with one or more accessory phenomena, such as nausea, vomiting, nystagmus, pain, deafness, etc., which accompanying phenomena are of considerable importance in localizing the mechanisms involved and in determining the nature of the lesions.

The majority of all vertgioes are labyrinthine in origin, since this organ is the chief station for the reception of spatial stimuli. Probably all true vertigoes are conditioned by some involvement of the paths of the vestibular nerve, whose connections, however, are very intricate and complex. A number of reflex vertigoes are known, but thus far a thoroughly satisfactory anatomical explanation for them, in their relation particularly to the vestibular apparatus, has not passed entirely from the stage of probable inference to that of anatomical proof.

Inasmuch as a rational therapy of the phenomena of the vertigoes must be founded upon the physiological and anatomical considerations—without a knowledge of which no true diagnosis can be made—a brief summary of such facts as are at present available, with some suggestions as to clinical methods for testing disturbed vestibular functions, is desirable.

It has been established without much question that the ear labyrinth is the chief organ of the body connected with the receiving of impressions of its position in space, particularly for the head. Adaptations to the physical laws of gravity and of inertia are its chief concern. It is adapted to the mechanical stimuli of these laws largely through the otolith organ, which reacts to changes in the incidence and degree of pressure upon its sensory end organs, due to changes in the specific gravity of its surrounding fluids; and also through the semicircular canals which react to changes in position in the three planes of space. The slightest change of the body in space is felt by this apparatus, and in the normally functioning central nervous system any such change is reflexly reacted to by appropriate motor response. This motor response, however, is a complicated mechanism, and all of its elements are not thoroughly analyzed. One of its parts is that of a reflex muscular tonus, by which the ordinary posture of the body is maintained. It is this function that has entitled it to the title of the tonus labyrinth.

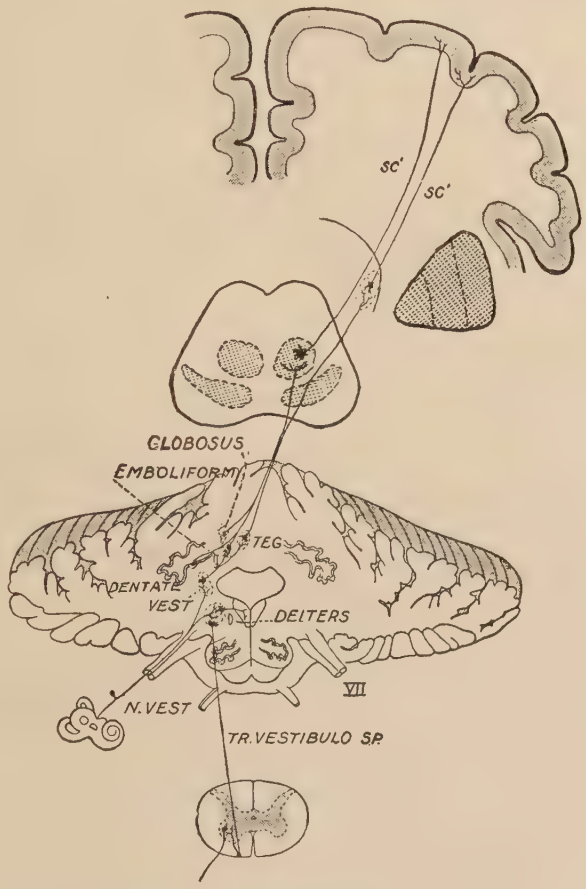

FIG. 4.—CENTRAL PATHS OF THE VESTIBULARIS. (Bechterew.)

Just what the complicated interrelations between the proprioceptors of the limbs, muscles, joints, etc., which carry impressions of movements, strains, tensions, etc., and the receptors in the labyrinth may be will not be entered into here. Sherrington has analyzed them exhaustively. The result is the maintenance of the reflex posture of the body, including the compensatory reflexes in the head, and those muscles of the head capable of changing the sense of consciousness of position—the eyeballs in particular.

The labyrinth belongs to a series of organs, then, that work chiefly with physical stimuli. It is a part of a great system of connections—which Sherrington has designated a proprioceptive system—which gives the animal, human as well as others, a definite attitude toward the external world, that is, space. It is the most important of these organs. It is

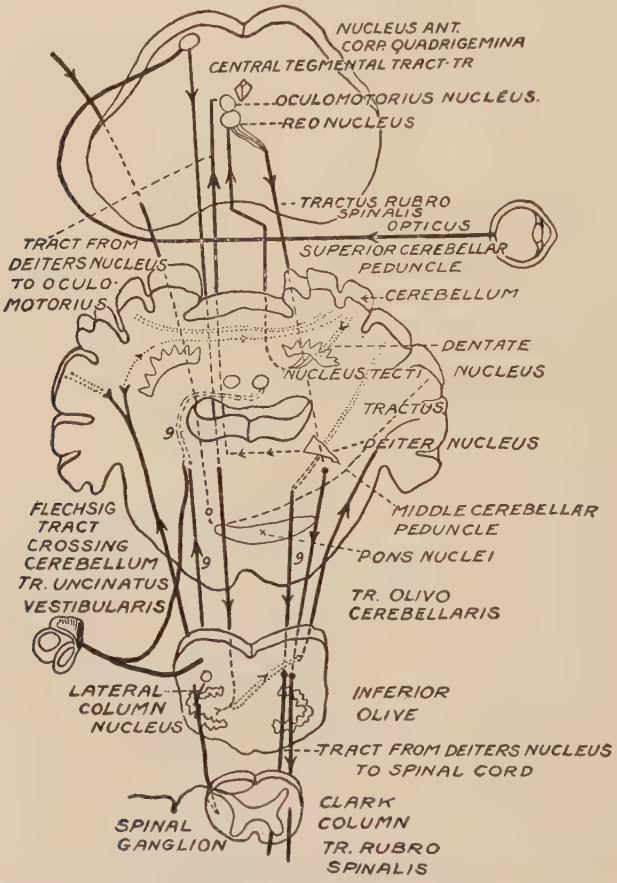

Fig. 5.—Scheme of Chief Paths Involved in Receiving Spatial Impressions and in Producing Motor Adaptations to Space Localization. (Lewandowsky.)

connected in a system with other nervous structures performing their part in the same general function, and each segment of the body is caught up in the chain of connections from the lower end of the spinal cord to the frontal area of the cortex.

This whole complicated system of end organs, fiber connections, long and short fiber tracts has its chief center just as every other reflex system has its center. The chief center or head ganglion of this whole proprioceptive system is the cerebellum. The cerebellar connections of the ves-

tibular system, the vestibulospinal, vestibulobulbar, vestibulocerebellar, and, finally, the cerebellorubrocortical components which carry those fibers whose functioning is recognized in the consciousness of space relations are now fairly well known, not in their entirety, but in their main tracts and connections. Hence, disease or disorder which shows any perturbation of the function of orientation in space may be more or less accurately localized along the fiber tracts, carrying the necessary impulses underlying these functions, and an appropriate therapy adopted.

The more precise anatomical description, of which the foregoing is a general résumé, as shown in the work of Brouwer, Magnus and Klein, Winkler, etc., may be summarized in the following descriptions of the vestibular paths and the accompanying figures of von Bechterew, which show at a glance the chief anatomical features present.

Nervus Vestibularis.—The fibers of the median acoustic root (Lewandowsky—mixed) constitute the central prolongation of the bipolar ganglion cells which make up the vestibular or Scarpa's ganglion. The peripheral prolongations of the cells originate in the walls of the semicircular canals. The thick bundle of the median root pushes its way between the spinal trigeminus root and the corpus restiform (inf. cereb. peduncle) lying at first close to the median edge of the spinal accessory nucleus, and reaches dorsally like the tines of a fork toward the end nuclei. These end nuclei of the vestibular are the triangular and the large cell nucleus.

Triangular Nucleus.—At the upper exit level of the hypoglossus laterally from the IX-X nucleus there begins a uniform gray area which stretches toward the middle raphé, pressing these nuclei, as the XII nucleus disappears. It has the form of a right-angled triangle whose hypoteneuse is made up of the floor of the fourth ventricle. Cerebrally, it develops more laterally and disappears in the neighborhood of the abducens nucleus (VI). Throughout the entire region there are found disseminated large and small cells developed in a thick network of fibers showing no tendency to grouping, although the cells lie thick at the medial and ventrolateral angles. Further large cells are commoner along the entire ventral border. In Weigert-stained specimens the triangularis is dark by reason of the many interlacing fibers. One sees above the median portion the fine fibers of the dorsal longitudinal bundle of Schütz. A fairly circumscribed and constant but very small group of cells lies in the dorsal angle of this nucleus, reaching dorsally and spinally beyond the limits of the triangularis. It is the nucleus-funiculi teretis, and has, so far as present anatomical methods have revealed, only uncertain direct connections with the triangular nucleus.

Large Cell Nucleus.—Under this term is grouped a number of separate nuclei belonging to the end station of the vestibularis. With the beginning of the inferior cerebellar peduncle one finds on the median

side a quadrangular area which consists of round cross-cut nerve fibers between which nerve cells are distributed (formatio fasciculata). Roller showed that these fibers originate directly from the acousticus, constituting a spinal acoustic root. As one passes cerebrally the area of the gray substance (nucleus descendens) increases, and especially in the upper levels, at which the fibers of the main portion of the median root bend laterally and ventrally, one finds a grouping of especially large cells, which is termed the Deiter nucleus. This lies in the floor of the fourth ventricle in its lateral portions. In the lateral angle of the ventricle, also dorsolateral from these especially large cells, and also reaching into the cerebellum, are small cells which Bechterew has regarded as special endings of the vestibular nerve; the vestibular nucleus, Bechterew's nucleus, nucleus angularis.

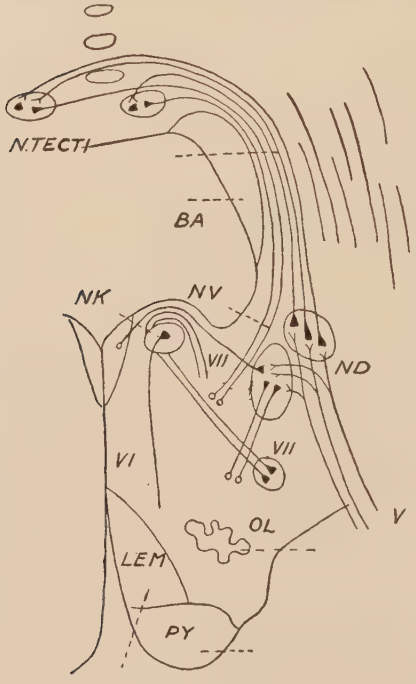

Fig. 6.—Scheme of Central Paths of the Vestibularis. V, Vestibular; NV, Nucleus Vestibularis; ND, Deiter's Nucleus; VC, ascending path from Vestibular to Cerebellum; NT, Tectal Nuclei; OL, Inferior Oliva; PY, Pyramidal Tract; L, Lemniscus; VII, Facial Nucleus; VI, Abducens.

Thus the large cell nucleus consists of (1) spinal acoustic; (2) Deiter's, and (3) Bechterew's, nucleus. Cajal describes also a crossed root of the vestibularis whose bundles can be traced along the dorsal border of the spinal trigeminus root through the raphé and can be followed to the other side (Bechterew).

Of the connections of the end nuclei of the vestibularis those to the cerebellum are the plainest. Strong, somewhat swollen bundles of nerve fibers go from the Deiter and Bechterew nuclei dorsally in the cerebellum. Fibers from the nucleus triangularis also join them. The acoustic cerebellar tract lies on the medial side of the inferior cerebellar peduncle, in the medial portion lateral from the superior cerebellar peduncle in which a portion also goes.

The majority of the bundles go to the cerebellar worm and end, mostly crossed, in the nuclei of the roof (tectalis), probably also in the nucleus globosus and nucleus emboliformis.

Within the superior cerebellar peduncle portions it may be said that, according to Bechterew and Flechsig, the Bechterew nuclei are connected

by means of commissure fibers which pass out with the superior cerebellar peduncle from the cerebellum and bend arcwise in the posterior angle of the crossing of the superior cerebellar peduncles.

Of the further connections of the vestibularis the following may be said:

1. From the median angle of the triangular nucleus there go numerous, but not arranged in bundles, fibers through the posterior longitudinal bundle through the raphé and tegmental areas. They probably constitute a central connection of these nuclei. From the entire ventral edge of this area there go numerous isolated fibers which go ventrally in fine groups deep into the substantia reticularis in the region of the cells of the nucleus lateralis medius.

2. Out of the large cell nucleus strong fibers go in a ventromedial direction, partly crossing through the outgoing root of the facialis to the tegmental region, and here bend between the sixth and seventh nerve longitudinally either cerebrally or caudally. These last fibers belong in the ventrolateral portion of the homolateral and partly heterolateral anterior ground bundle as the vestibulospinal tract. None of these fibers come from Bechterew's nucleus.

Other fibers pass medially and as arcuate fibers go to the raphé and the contralateral tegmentum, and hereby probably go to the brain cortex.

The addition which the posterior longitudinal bundle receives from the large-celled nucleus is of importance.

Further, it is easy to find fibers which go from the Deiter's nuclei into (or perhaps only through) the abducens (VI) nucleus, also not a few fibers join the corpus trapezoides which originate from Deiter's nucleus.

Symptoms.—Pure vertigo consists in the loss of the sense of static equilibrium, and shows itself in a variety of ways and in varying degrees, according to the individual and his attitude in space—standing, lying, moving, etc.

In the milder grades one has the sensation of uncertainty, one fears one is about to fall, forward or backward, or sideward. The slight reel of the intoxicated individual, clinically a vertigo, is conditioned by impairment of sensations of the joints and muscles which is part of the proprioceptive reflex arc already alluded to. Other patients feel as though they were turning about in space, others that space is turning about them; objects are rotating about them and they are still, or they are rotating and the objects are still. The optical illusion, so called, of the sense of individual movement experienced by one who is seated in a non-moving train while a train is moving alongside is an illustration of this type of vertigo, but here only the cortical and optic fibers are involved. In some

circular panoramic shows with a rotating canvas one obtains true vertigo sensations. Rapid rotation on a piano stool will induce a rotatory vertigo.

Or the patients may have only a sense of unreality of their position sense; they may be swimming or floating in the air; consciousness is confused and unable to record any focal points.

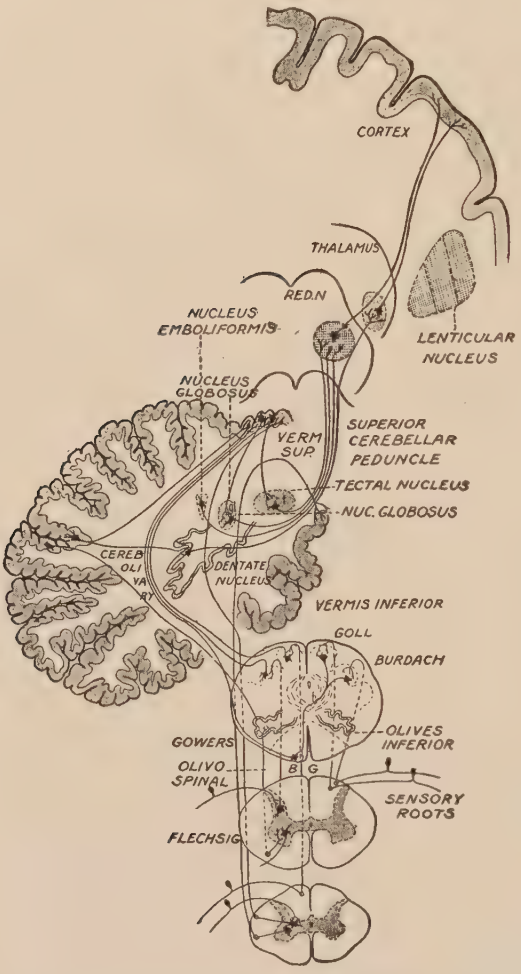

Fig. 7.—Scheme of Incoming Sensory Fibers Subserving Static Equilibrium. (Bechterew.)

Various vertigoes show on effort to walk. The patients sway, the reflex attempts at adjustments are underefficient or overefficient, the patient is steered to the left or to the right, or forward or backward, or makes menagery movements, or irregular zigzags, first in one direction and then in another—all conditioned by the disturbed efficiency of the reflex apparatus whose inadequacy is constantly recorded in consciousness by the sense of falling, and often conscious efforts at repair are the occasion for the overcorrection or the undercorrection of the defect. This is often true in cerebellar cases, which may show the classical "drunken" gait. The vertiginous retropulsions or propulsions of the paralysis agitans patient are other illustrations of interference with striatum components of the muscle tone mechanisms. These are allied to the forced movements.

Accompanying phenomena are numerous and diagnostically important. Nausea, vomiting, weakness, unconsciousness, pain, roaring and buzzing in the ears, deafness, ataxias, incoördinations, asynergias, adiadokocinesis, disturbed reflexes, tremors, forced movements, nystagmus, convulsions, blindness, mental deterioration, etc.; these, singly or in combination, are among the many

accessory phenomena which may be associated with vertigo, and which by their combination determine the diagnosis.

Clinical.—We have limited our description of vertigo to some involvement of the vestibular portion of the proprioceptive system, either peripherally in the labyrinth or centrally in the extracerebral or intracerebral or cerebellar paths and connections of the vestibular nerve. Certain vertiginous sensations, however, are met with which are allied but remotely with this conception, and these had better be dealt with before approaching the chief vertigoes.

Vertigoes of Impaired Cerebral Circulation.—Here dizziness, faintness, and partial or complete loss of consciousness are often accompanied by vertiginous sensations. Here there is a loss of consciousness of general space relations which is not related to those of static coördinations, as it should be in true vertigo, but is a part of an impairment of general consciousness.

Grave anemia, cardiac defects, severe pain, these may occasion the vertiginous attacks. They do not properly belong in this subject, and their therapy must be sought under anemia, hyperemia, heart disease, etc.

Reflex Vertigoes.—A number have been described, but if a complete examination of the labyrinth be made it has been found that many can be referred here. This is true particularly of the gastric vertigoes so widely described. Certain vertigoes are frequently associated with a chronic sclerotic gastritis in which there is marked constipation. The mechanism of these vertigoes is not understood. They are most frequently termed toxic vertigoes—from unknown and hazy indefinite toxemias. Vomiting, which is often intense, is known to modify the pressure in the labyrinth, which, in turn, may account for the vertigo in those gastric cases not accompanied by any aural complications (Raymond).

Arteriosclerotic Vertigoes.—These are usually associated with hypertension, which hypertension involves the cerebrospinal fluid and the labyrinthine fluids (Lafite, Dupont). Many of the so-called arteriosclerotic vertigoes are associated with tinnitus, loss of high-pitched tones, and diminution in bony conduction.

The proper therapy here is directed to a reduction in the arterial tension—at times even requiring lumbar puncture. Iodids and chloral are useful. It is doubtful that a rigid dietetic regimen has much effect. A definite withdrawal of excessive calcium in the diet may possibly retard the calcification, in which case the familiar bread and milk, ideally prescribed by dietetic savants for the aged parent, would be anathema maranatha.

Toxic Vertigoes.—Here one may consider the vertigo due to certain drugs, such as salicyl derivatives (salicin, quinin, etc.), the nicotin series (tobacco), alcohols (veronal, trional, etc.). Both quinin and nicotin have a specific toxic action upon neural elements such as those of the labyrinth and of the retina—tobacco amblyopia and quinin amblyopia are well-

known toxic reactions which are paralleled by the vestibular reactions showing themselves in vertigo. The action of the alcohols on all sensory fibers is sufficient to account for alcoholic vertigoes.

Certain rarer toxic vertigoes are met with in pellagra (here probably a sensory neuritis), in Gerlier's disease—probably associated with involvement of the posterior longitudinal bundles (ocular muscle apparatus).

Vertigoes which follow the acute infectious diseases are uniformly due to secondary complications in the labyrinth.

Vertigoes Associated with Epilepsy.—In certain patients petit-mal-like attacks occur with vertigo, pallor, confusion, partial falling, tinnitus, and sometimes nausea. These cases are often differentiated with considerable difficulty. Examinations of the labyrinth should decide and determine the therapy.

Attention should further be directed to another type of epileptiform convulsions associated with vertigo. These are the cerebellar fits of Jackson and point, with other symptoms, to disease of the cerebellum.

Labyrinthine Vertigoes.—These constitute 90 per cent of all of the clinical varieties. From what has preceded it is seen that the arteriosclerotic, toxic, and reflex vertigoes may be also labyrinthine.

One of the most pronounced types of labyrinthine vertigo is *seasickness.* Train sickness is another variant of the same disorder. The individual with rapid labyrinthine reactions is apt to suffer from seasickness which is nothing more than hyperstimulation of the semicircular canals in which particular the superior canal is the most important. Hence the dramatic effects of a rolling sea in contrast with one in which the boat pitches.

Treatment.—For many patients there is none. They must grin and bear it and hope the boat does not roll. Many have made up their minds to be sick, and sick they will be. With the large modern steamships the terrors of seasickness have almost disappeared.

Seasickness has nothing to do with the stomach, and the most elaborate antidietary arrangements have little effect. The prospective ocean traveler should pay little or no more attention to his stomach than common sense dictates. Many prospective travelers fail to remember that cold, damp weather is not unusual on the ocean at all times of the year, and fail to be provided with warm garments. The chilliness due to a wabbly vasomotor control—through the labyrinth—and that of the ocean is one of the bugbears of the seasick individual. Warm clothing will remove one element of this.

Rooms about the middle of the boat are preferable, but end rooms are rare in the new vessels. Plenty of circulating air in one's cabin aids in cultivating a normal state of mind to the many smells and stuffy sensations in ocean traveling. Pay no attention to drafts; we strain at gnats and swallow camels constantly in our superstitions about drafts.

Sensitive individuals can gradually accustom themselves to the labyrinthine hyperstimulation by reclining whenever the motion is appreciable, and reclining in such a position that the motion is least felt in the superior canals. Thus they should shift their chairs according to the roll or pitch. When the vessel is quiet it is best for such patients to get about as they would under ordinary circumstances.

It is well for the affected individual to recline from the first—and preferably on deck. One would best keep the eyes shut if the horizon is bobbing up and down, as the necessary constant adjustment of the eye muscles aids in causing sickness. On very bright days tinted glasses help to restrain the glare. An interesting series of books, during the reading of which the traveler can close his eyes and ruminate, is advantageous; too continuous reading is not to be advocated. The playing of cards is a useful and advantageous change. It diverts attention.

In lying down one should lie as flat as possible—semireclining does not so place the plane of the superior semicircular canal as to cause the least flow of fluid possible within it. Half sitting up is as bad as standing up. One flat pillow is about all that one should use.

Inasmuch as it is easier to vomit something than nothing sick individuals should eat. If they lose one meal eat another. Nothing is worse than the endless retching of an empty stomach, and especially one made more irritable by fear. The action of champagne and alcoholic liquids is partly suggestion and partly the elimination of fear. Alcoholic beverages are of a certain specific value, especially as they tend to anesthetize all receptor structures and hence diminish excitability. Those accustomed to them will be helped less than novitiates.

One should try to eat immediately upon arising or sooner. Here fruit is useful. It matters little what one eats; those foods most liked are best. Any food not relished when well is best avoided. If one detests clam broth, or meat broths, one should not believe they are panaceas for seasickness. They are not. The oftener one vomits the oftener one should eat or swallow liquid food.

It is very uncomfortable sitting in a stuffy dining room waiting for one's food. Hence go to dinner just as it is about to be served, and begin to eat immediately. After eating it is a good plan to lie down for a short time and not stamp about deck under the delusion that one is aiding digestion.

The unusual changes in habits are apt to bring about constipation, especially when one eats very little; this is best counteracted by eating more fruit and salads, drinking plenty of liquids, or by an occasional pill of aloes, aloes and mastic, or similar laxative.

The headache of seasickness is best combated by eating, by coffee, and by small doses of bromids and phenacetin. The widely used headache mixtures incorporating caffein and antipyrin in the elixir of sodium bromid

are useful. The sodium salt of veronal in doses of from 8 to 10 gr., given by rectum in suppository, is a very useful remedy in causing sleep and in relieving excessive irritability of the labyrinth.

Vestibular Vertigoes.—At one time loosely grouped together under the term "Ménière's disease," the analyses of later years have shown a great variety of these affections depending upon the anatomical site of the lesions. One must distinguish between:

1. Disease of the peripheral end organ (*a*) partial, or (*b*) complete —these are the vertigoes of partial or complete labyrinth disease.
2. Disease of the first neuron (*a*) paresis, (*b*) paralysis of the vestibularis.
3. Disease of the primary end nuclei in medulla and of Deiter's nucleus. The latter gives a special symptomatology termed Bonnier's syndrome.
4. Disease of the region of the posterior longitudinal bundle—associated with eye movement vertigoes.
5. Disease of the nuclear region of the eye muscles in the corpora quadrigemina.
6. Disease of the pontine eye nuclei.
7. Disease of central eye paths.
8. Disease of cerebellum.

In disease of all these regions vertigoes are to be expected by implication of the vestibular nerve; the character of the accompanying phenomenon, especially the nystagmus, determines the location.

1. In partial or circumscribed disturbance of the vestibular end organs in the labyrinth the vertigo is associated with nystagmus movements. The nystagmus is spontaneous, and shows a long slow, due to the vestibular, and a quick return movement due to the tegmental nuclei, the direction of the quick movement naming the nystagmus. Vestibular nystagmus usually increases when the eyes are directed in the direction of the quick movement, and usually diminishes or ceases on looking in the opposite direction. There is usually always a combination of horizontal and of rotatory nystagmus. Barany states that every other form of spontaneous nystagmus is of intracranial origin. If the nystagmus movement is rotatory and horizontal it must be determined whether it is peripheral or central. A peripheral nystagmus to the right should show on caloric, pressure, rotation tests that the right vestibule is functionally active. Should such tests show an inactive right vestibular then the nystagmus must be of central origin. If the right vestibular is active then continued observation of the nystagmus will alone determine. Should the nystagmus continue uninterruptedly twenty-four hours or more it is of intracranial origin. If it lasts a shorter interval, is interrupted by quiet intervals, it may be either peripheral or central. When there is nystagmus of the well

side as well which lasts about two weeks, gradually decreasing, then a peripheral disturbance seems certain. Intracranial nystagmus is not so apt to diminish.

The Ménière-like attacks are either mild or marked. Buzzing in the ears is rare in the mild attacks. Thre is no impairment of hearing. In the severer attacks there is little buzzing, but hearing is apt to be impaired. In free intervals the nystagmus diminishes or disappears, the Barany caloric reaction is diminished on the sick side.

Total destruction may be acute or chronic; the latter may show no symptoms. The former sets in with violent vertigo, nausea, vomiting. There is marked horizontal and rotatory nystagmus of the well side. The slightest movement of the head increases the vertigo and nystagmus during the first forty-eight hours; the latter gradually disappears in three to four weeks. There is marked loss of incoördination, with tendency to fall to one or the other side. After the period of quiescence of the nystagmus caloric and rotation tests show the defective function. The galvanic reaction is not usually affected.

2. Disease of the vestibular nerve—usually due to tumor of base (acoustic, cerebellopontine angle)—leads to similar reactions. Here, however, there seems to be a difference in that Neumann has found that the galvanic reaction is reduced or lost, according to a partial or complete destruction of the vestibular ganglion. Other cranial nerves are here involved as a rule. The cochlearis is frequently involved. Complete deafness does not result. The trigeminus is also often involved and pain, paresthesiæ, or motor defects appear. Cerebellar symptoms may also complicate the picture. The nystagmus is apt to continue in intensity with tumors, and may be on the sound as well as the affected side.

3. Involvement of the nuclei (encephalitis, abscess, syphilis, tumor) brings about similar attacks of nausea, vomiting, vertigo, and nystagmus. The symptoms continue and increase as a rule beyond the three weeks ordinarily seen in the labyrinthine disease.

The method of continuous observation aids in locating the diseased focus.

Bonnier's syndrome—due to implication of Deiter's nucleus and contiguous structures—usually causes a marked attack of nausea, vomiting, vertigo, and nystagmus with buzzing in the ears and deafness (Ménière's syndrome), with irradiations to the ninth and tenth nerves causing anxiety, tachycardia, and hemiplegic weakness. The trigeminus and oculomotor are also apt to be involved. Bonnier has also described peculiar somnolent attacks accompanying his syndrome. Little can be done for these cases unless the focus is of syphilitic origin.

4, 5, 6, 7. Here vertigo and nystagmus are associated in various ways, but the vertigo disappears on closing the eyes. Here forced movements, conjugate deviations, and various skew deviations afford a clew

to diagnosis. Caloric and other tests determine the integrity of the labyrinthine functions.

8. Cerebellar vertigoes have a number of special features. So far as the vertigo is concerned they may not be separable from the labyrinthine or vestibular vertigoes. Hearing symptoms are usually absent. The nystagmus is less apt to be horizontal and rotatory, but may be up or down or oblique, and is usually directed toward the affected side.

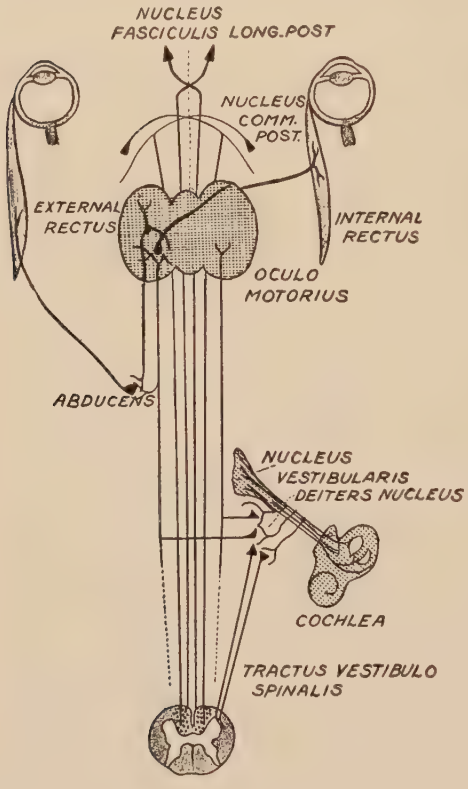

Fig. 8.—Scheme of Ocular and Vestibular Connections.

There are usually also symptoms of a tumbling gait toward the site of the lesion; there are asynergia and usually adiadokocinesia. No real distinction as to the side of the lesion affected can be gained from the fact as to the subjective or objective motion of the objects during a vertiginous attack. Closure of eyes has no marked affect upon the vertigo nor upon the gait. Caloric and other tests determine a normal labyrinth.

Treatment.—Here there come into consideration the surgery of the ear and the surgery of the cerebellum and cerebellopontine angle. All of these subjects are considered elsewhere in this volume. The ear specialist should treat the labyrinthine cases, not the neurologist. Rest in bed, quinin, and the usual medical treatment which shuts one's eyes to the danger of a suppurative labyrinthitis, brain abscess, etc., is folly.

In the apoplectic form of the Ménière's syndrome (hemorrhagic labyrinthitis)—often mistaken for a cerebral, or cerebellar hemorrhage—the patient must be kept absolutely quiet, the eyes should be kept closed, the room darkened, and all noises excluded as far as possible—telephone, house bell, etc., shut off. Ice should be applied to the mastoid. Leeches are at times of value. The continuous vomiting may be in part relieved by swallowing cracked ice. Surgical interference may be called for.

In luetic cases mercurial injections, arsphenamin, or inunctions are called for. It may be noted that the acute labyrinthine disturbance which

has been known to occur after the use of arsphenamin is probably due to the syphilis and not to the arsenic (Benario).

Sodium bromid, chloral, antipyrin, morphin offer the best medical aids in giving relief to these patients in the acute stages.

Aural Vertigoes.—These may be referred to briefly, for although the vertigo is due to pressure upon the labyrinthine fluids the main lesion may be in the external or internal ear (extralabyrinthine). Removal of cerumen is the first procedure. A more complete therapy of vertigoes due to intratympanic exudates, suppurative, or non-suppurative middle ear inflammation, amylosis of the ossicles, adhesions to the stapes, polypi, cholesteatomata, etc., belongs within the sphere of the diseases of the ear.

Ocular Vertigoes.—It has been seen, from the anatomical discussion, that the nervous mechanism of the eye muscles, by which they are adjusted to binocular vision, and by which the knowledge of the horizontal and the estimation of distance is brought about, is also connected up by collaterals of the posterior longitudinal bundle with collaterals from the vestibular apparatus; as may be seen in the accompanying scheme.

The various illusions, such as moving of trains, etc., may be accompanied by vertigo; car sickness is largely due to the necessity for continuous rapid ocular adjustments, as well as some labyrinthine disturbance. It is best treated by reclining with the eyes closed. Various errors of refraction, forms of astigmatism, by causing unequal stress of muscular balance, may induce vertigoes. These are relieved by the proper glasses, or operative procedure upon the eye muscles—which latter is rarely called for, save by a few faddists. Ocular vertigoes from arteriosclerotic disease in the aged are frequent. Here eye nuclei pathways are involved in thrombotic softenings. The great majority of neurasthenic vertigoes are abortive labyrinthine vertigoes, or are due to chronic otitic lesions, which are not infrequent accompaniments in chronic neurasthenic states. The treatment of the ear condition is of advantage both for the neurasthenic fatigue and for the vertigo. Hysterical vertigoes are rare. Dizziness and mild vertiginous sensations are extremely common, and are reflections of fatigue, mild chronic ear disturbance, excessive use of the eyes with ocular vertigo. That such sensations should be found in hysterical individuals can readily be grasped. Pseudo-Ménière attacks of a psychogenic nature are not uncommon. It is better to interpret these vertigoes as due to good and sufficient causes yet unknown than to shut one's eyes to careful methods of examination by calling them "hysterical." Vertigo is a not uncommon symptom in the "anxiety neurosis." This frequently found syndrome is best treated by careful readjustment of the sexual life of the patient. Sexual is here used in the broadest sense.

TREATMENTS FOR THE EPILEPSIES

Smith Ely Jelliffe

Introduction.—Like headache, vertigo, fever, and other general terms, epilepsy, while representing a characteristic and classical phenomenon, is not an entity in the sense that it is always the result of similar causative factors. For this reason science has agreed to speak of *the epilepsies,* recognizing their manifold nature and varying etiological factors.

Such a mode of approach is alone tenable if therapeutic considerations are to be effective. The familiar cry "treat the patient and not the symptom" needs to be reiterated when the subject of epileptiform convulsions is under discussion.

A rigid differential diagnosis, then, is an essential. Such a diagnosis not only should exclude convulsive seizures not due to brain diseases, such as occur in hysterical states, in the compulsion neuroses, etc., but it should also be directed toward a separation of etiological factors within the epilepsy group proper. Thus it hardly needs stating that epileptiform seizures, which not infrequently are the precursors of general paresis, call for an entirely different mode of approach than those due to chronic alcoholism or to multiple sclerosis.

It is here assumed that the great mass of epilepsies is due to definite brain changes. For the most part epileptic convulsions rest upon as solid an organic basis as general paresis or some similar disorder conditioned by brain disease. Yet, it is also certain that transitory changes may take place within the cerebral cortex which may give rise to one or more epileptic seizures and then recede.

The most characteristic of these changes is seen in toxic states, notably in alcohol, where a tissue edema interferes with the normal functioning of the complicated motor mechanism of the brain. Such a related tissue edema is also seen in certain forms of endogenous or autotoxemias—the acid intoxications—such as are seen in defective thymus activities, in defective parathyroid functioning, where it has been inferred that there is an interference with the calcium intake, which in its turn does not combine with the body acids. In experimental thymus animals a well-marked tissue swelling and edema are present in the nervous system. This tissue edema is the cause of the epileptiform convulsions seen in these animals after thymus extirpation.

The question is still further therapeutically complicated when just this general group of cases comes under consideration. The possibility, even the probability, exists that chronic intoxications of the general nature of those just outlined can give rise first to recoverable—then, later, to irrecoverable—tissue changes. A toxic gliosis is set up which ultimately

forms a definite pathological alteration, easily demonstrable by histological means, as Alzheimer and others have abundantly proved.

The epilepsies of nephritis, of diabetes, of lead poisoning, of alcoholism need only to be mentioned to be dismissed to their appropriate sections for consideration.

But there are still other conditions which may determine epileptiform seizures of a less sinister aspect, or they may so closely simulate them as to make it extremely difficult to make a separation. In his borderland studies Gowers has laid special emphasis on these phenomena. They include faints and fainting fits, vagal and vasovagal attacks, certain vertigoes—already treated—and certain migraines, likewise referred to in that section.

Certain fainting spells bear a close resemblance to minor epileptiform or petit mal attacks. The more frequent mistake, however, is to regard petit mal attacks as fainting spells. When these are cardiac in origin one rarely finds excitement following the attack, whereas in petit mal such motor manifestations are frequent. Proper cardiac tonics also aid in establishing a normal state and clearing the diagnosis.

Vagal attacks, due to pneumogastric disturbance, often resemble minor epilepsies. There is usually some gastric, respiratory, or cardiac distress, with pain and a sense of suffocation and of impending death. The extremities are usually cold, from vasoconstrictor increase, slight tetanoid spasms occur, with partial clouding, unconsciousness, and a certain mental heaviness. These attacks usually last from ten to fifteen minutes, and may continue for an hour. Moreover the development is gradual. The close relationship of these attacks to the attacks of anxiety neurosis of Freud should not be overlooked.

Put in tabular form, for the purpose of obtaining a quick review, one may divide the epilepsies, according to strict etiological principles, somewhat as follows:

Tabular Scheme of the Various Epileptiform Convulsions

1. *So-called Functional Epilepsies—Idiopathic Epilepsies.*
   Psychogenic attacks. Affect epilepsies of Bratz.
   Hystero-epilepsy. Epileptiform attacks of the anxiety and compulsion neuroses, dementia præcox. Manic depressive equivalents, narcolepsies.
2. *Epilepsies of Gross Brain Lesion—Meningeal, Vascular, Parenchyma, or Bony Disease.*
   General paresis—acquired and hereditary.
   Cerebrospinal syphilis.
   Dementia præcox.
   Brain tumor.
   Brain abscess.

Cysts, echinococcus, *et al.*
Pachymeningitis interna.
Syphilitic meningitis.
Tuberculous meningitis.
Serous meningitis.
Bony tumor of skull.
Bony and meningeal injury, traumatisms, fractures, etc.
Multiple sclerosis.
Cerebral sclerosis.
Arteriosclerosis (senile, Alzheimer's disease, etc.).
Syphilitic arteriosclerosis.
Encephalitides.

3. *Epilepsies of Microscopic Brain Disease.*

Those conditioned by transitory or fleeting, more permanent tissue changes—chiefly acute or subacute edemas—or changes in vascular supply. Acute or chronic nephritis (uremic diabetes), metallic toxemias: notably bromids, lead, arsenic (including 606), Herxheimer reaction. Other toxemias: alcohol, CO_2, blood acting drugs, malaria, parasites—rabies, etc., internal secretions—thymus, thyroid, parathyroid.

Those due to microscopic alterations following the acute infectious toxemias (scarlet fever, typhoid, influenza, measles, whooping-cough, *et al.*).

Unresolved factors, possibly toxic: bacterial, chemical, or anatomical.

With such a review in mind the therapeutics become extremely diversified. There is no longer any point to the question, How shall we treat epilepsy? any more than to the question, How much does a house cost in New York? The question must always be answered. Why! is the epilepsy?

Symptom Review

Having excluded the borderland cases which have nothing to do with epilepsy one can plunge directly into the midst of the epileptic medley. In this group one distinguishes at once at least three series of phenomena which present widely differing aspects, but yet are all constituent parts of the disorder when seen in its fully developed form. These are the convulsive seizures, petit mal attacks, and the psychical equivalents.

The convulsive movements are most sterotyped, and are either general (hippocratic), or localized (jacksonian). The petit mal attacks present a number of minor variations to be noted later, whereas the psychical attacks present unusually wide modifications from the slightest increase in irritability to homicidal acts, fugues, and other very diverse symptoms.

As this chapter is not a treatise on the epileptic phenomena, only those salient features which are of diagnostic importance will be touched upon.

The Major Epileptic Attack.—The chief features of the attack have been described at length, and with precision since Hippocrates wrote his treatise on "The Sacred Disease."

In the classical major epileptic attack the patient suddenly loses consciousness with or without any preceding warning or sensation of an impending attack (aura). He may cry out, a harsh peculiar cry, then fall, and the muscles of the body stretch out, in irregular progression, in a state of tonic contraction. The fists close, the legs extend, the muscles become tense and rigid, in a sinuous, advancing, and fairly deliberate manner. The face is distorted, and soon becomes livid. Alternations in the tension produce stiff, slow contortions, with oncoming remissions or with progressive shivers. Then a period of convulsive movements follows. Relaxation and contraction take place in rapid alternation, the chest heaves, the body is jerked about, the jaws open and shut. "A clotted mass of motion" is the significant expression of Hughlings Jackson. The lividity increases; urine and feces may be passed, and after a period of a few seconds the patient, still unconscious, ceases to jerk, usually abruptly, and a deep sleep, lasting for a few moments to several hours, terminates a most gruesome performance. On awakening the patient is usually amnesic to all that has occurred, and there are no gross signs of altered motor function, save, perhaps, fatigue phenomena. During the attack the pupils are usually dilated and immobile to light; the patient does not respond to any external stimuli, even the most painful. Just after the attack there is usually a positive Babinski sign in both lower extremities. The intensity of the amnesia may vary somewhat, as Maeder has shown by psychoanalysis.

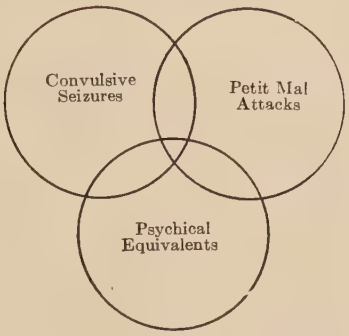

Fig. 9.—General Diagram Showing Mixture of Symptomatic Trends.

This is a very general description of the major epileptic attack. There are numberless variations and modifications in the symptoms when viewed in detail. These can be found in the great monographs of Férê, Voisin, Binswanger, Spratling, Turner, and Gowers, and in the full discussion of the textbooks of Oppenheim, Starr, Lewandowsky, Jelliffe and White, and the Osler and Allbutt *Systems of Medicine.*

Minor Attacks or Petit Mal.—These are extremely variable. Many patients will show a preponderance of such attacks—in others they may be rare; in still others only petit mal attacks are known. The proportions are individual and do not allow of detailed statement.

In these slight attacks there is usually only a temporary lapse of consciousness. The patient may halt in his speech a moment, have the sense of being lost, and then go on; they may stagger a moment, and even sit down, or lie down, and then get up. There is usually a premonitory blanching, some aura, or some slight twitching movements of the fingers, or hand, or the muscles of the face. The patient may then be a little dull or sleepy, or may go on with her work or play as if nothing had occurred.

As with the major attacks one finds on reviewing a large number of cases great variation in the minor manifestations, yet the general features are very fixed and significant. The details may be found in the works already referred to.

Psychic Equivalents.—These are more diverse in their possibilities of variation than the other series of phenomena, and in certain of their forms more constant. Occasionally one finds an individual in whom the psychical equivalents are not known to be accompanied by any of the convulsive or petit mal features. This is rare, however, and can be claimed only after very searching analysis of the patient's life history. Many patients with psychical equivalents will be found to have had petit mal attacks, and the majority have had one or more major convulsive seizures —either nocturnal or diurnal.

The psychical equivalents vary from transitory states of restlessness and irritability to prolonged periods of violent mental excitement. In some a dipsomaniacal period is a true psychical epileptic equivalent. Sudden fugues occur in others, and the patients come to their usual mental state perhaps miles away from home. Some have even crossed the ocean and found themselves in foreign countries among strangers and those speaking an unknown tongue. Homicidal acts may be performed during such an attack. In the "Mad Hercules" of the early Greek poet Euripides such a homicidal act is as strikingly portrayed as in a much more modern textbook of nervous diseases. Epileptic dream states are frequently mistaken for drunkenness.

It would lead too far afield to attempt to outline the numberless variants of the psychical equivalents, many of which are still unrecognized, even by physicians, but two features should be accentuated—these concern the so-called epileptic character anomalies and emotional storms on the one hand, and the more striking epileptic dream states on the other.

So far as the mental features of the epileptic are concerned much might be said. Much more stress should be laid upon these than has been usual. The epileptic character is a fairly stabile thing, the attacks are episodic. Hence, in diagnosis, particular stress should be laid upon the mental characteristics of the individual sufferer from frequent epileptic attacks. In some such character anomalies develop more rapidly than in others, and most recent studies seem to point to close correlations between the character anomalies and the localization of the nervous tissue changes.

While a few epileptic patients show little modification of intellectual capacity the greater number concerned show slowness and difficulty with their mental processes. They grasp questions slowly, and do complicated mental computations with difficulty. Striking results may be obtained by proper use of intelligence tests, as devised by Ziehen and others, from the use of association tests, and especially the reckoning tests of Kraepelin.

In some there is a distinct deteriorating process leading to almost complete dementia. The idiotic, imbecile, and debile stages in juvenile epileptics need mention only.

There is often a striking poverty of ideas, which shows up with association tests. This usually leads to an enhancement of the ego of the individual and an increase in the emotional irritability of the patient. This emotional change is often very difficult to cope with therapeutically. The moody, selfish, contentious, negativistic epileptic is an exceedingly trying problem to manage.

Careful analysis shows that these patients have emotional attacks independent of the more classical symptoms of epilepsy. They have been studied particularly by Aschaffenburg. These patients wake up depressed. They may have had distressing dreams, often sensual in character, accompanied by ejaculations. They become sullen and resistant, look upon the dark side of everything, are reluctant to go to work, or busy themselves about the house. They may begin to tease or to find fault, to grumble and growl, at times are profane. In asylums or sanitariums they want to be let out, and are apt to be violent if opposed or argued with, often attacking with great brutality those who irritate them. Even homicide may occur as a result of such moods, and yet the patient knows what he is doing, and still is irresponsible. Here the legal test of irresponsibility, that is, of "knowledge of the act and whether it was wrong," is a farce. These patients are incapable of control by reason of a brain disorder; their knowledge of the act is only theoretically impaired.

These periods often alternate with fits of depression and anxiety. The patients are hopeless, never expect to get well, they are tired of life and want to find some relief from their discomfort and sense of incurable illness. Occasionally these patients commit suicide while in these depressed periods.

Attacks of excitement with euphoria and motor unrest are also met with, although this is a much less frequent mood than that of depression. The patient is then expansive, happy, even gay, speaks rapidly, may busy himself much with business things, or about the house, may show flight of ideas. They are often extremely irritable, commit violent acts, swear, or talk aloud for considerable periods.

Some patients develop very typical paranoid ideas, either following a convulsive attack or absolutely apart from the same. They become sus-

picious, have ideas of reference, of being followed. They refer their inability to hold a position to their being hounded or persecuted, and then they are apt to develop hallucinations of hearing. They often hear their names called—they are threatened. This irritates them greatly, and again one finds another opportunity for apparently motiveless violent acts. These acute, or subacute, mental states usually last only a day or two. They disappear as rapidly as they came. The patients laugh at the idea of their being followed, of having heard threatening voices, and cannot imagine why people should not understand them better, or even assume others to be crazy.

These types of attacks occur in from 70 to 90 per cent of all epileptics. From the therapeutic point of view it becomes highly important to recognize them in order to protect the patient from his own rash deeds. Often it is necessary to restrain his liberty for a time in order to protect others.

Another series of phenomena has been referred to already. These are the peculiar, and often startlingly weird, epileptic dream states. They are more frequently seen following an epileptic attack; occasionally they precede the attack—as in the case of Hercules, previously referred to—but they may also occur apart from and apparently unrelated to the convulsive seizures.

The simplest form observed is that of dreamlike confusion, which is often accompanied by hallucinations. The patients are able to walk, but they go about in a mild semistupor, as though half intoxicated. They see faces, hear voices, smell smoke, or hear bells, and talk about their surroundings as if they were in a daze. They frequently leave their work and commence to drink, or they start a fire somewhere—especially the young patients—or they go into a store and help themselves to anything that pleases them. Kraepelin tells of a patient who had set fire to his bed in order to boil some coffee; others have committed manslaughter in such a mild dream state. Others again are happy and go about in a merry jovial state. Such not infrequently urinate on the public highway, or show their genitals in public, openly masturbate, or may make definite sexual approaches.

After the period of dreamy confusion has passed there is a comparatively absolute amnesia for all that has occurred. Careful research by proper psychanalytic methods may show occasional memory islands, but such are disconnected.

Other dream states show themselves in night walking. Such is to be distinguished from the frequent turning, getting up out of bed, and loud talking of many nervous children. These epileptic patients often perform complicated acts. They get up out of bed, open and close the door, descend the stairs, light the gas, or a fire, rummage about in a closet, and then return and go back to bed after a few minutes or an hour or so. Their movements are highly automatic, they avoid obstacles, although oc-

casionally they walk out of a window and are injured or killed. With certain few individuals comparatively simple conversation can be carried on, poems recited, examples answered, etc. The unobservant lay person may not notice they are practically asleep (La Somnambula).

The severest grades are spoken of as epileptic stupor. The patients can eat and work, but do so as though in a deep drunken stupor—they are without any real knowledge of what is really going on; the amnesia is practically absolute. Their speech consists of a few broken words, or interjections, although occasionally they show continuous rhyming—echolalia or other types of automatic speech. Kataleptic phenomena are occasionally observed.

These dream states vary in duration from a few hours to two weeks—in rare instances longer—and the course is often characterized by variation in the intensity of the dream state.

One word should be said about the anxious delirium states observed in epileptics. This anxious delirium is one of the most practically important of the epileptic psychoses, as it occurs with comparative frequency in chronic epileptics, and is not associated with convulsive manifestations. It develops within a few minutes, or after a few hours. There is a period of anxious depression, of dreams, of peculiar sensations and haziness. Recurring, almost stereotyped (in the various attacks), hallucinations take place. The patient sees a "black man," or "red blood," or "a devil in a red mantle." Complete disorientation takes place, hallucinations increase, and then anxious delusional ideas develop. He is going to be delivered to the devils—thrown in prison—sent to the gallows, etc. There is a man outside going to shoot him. He is being poisoned, and a host of similar frightful ideas with visions reproduce Dante's Inferno within him. He falls upon his knees, prays to God, implores those about him to help him, or at times is scornful, and even bitter, in his anxiety. In this latter state such a patient is often extremely dangerous. He may commit the most ghastly crime. He may run amuck with inarticulate cries and bellow like an angry bull.

Such states persist a few hours, or even a few weeks. The anxious attacks are often mistaken for melancholic states.

A number of variants of these "dream states" are recorded in literature. One is reported by Alzheimer as having persisted eighteen months. Such cases, however, are extremely rare and need the most extreme critical scrutiny to pass muster as epileptic dream states—rather than forms of hysteria, aggravation, exaggeration, or simulation.

The Dynamics of the Epileptic Attack

The clinical syndrome of the epileptic attack in its many variations has become clearer and clearer with each generation of observers. It has

broadened a great deal since its earliest descriptions by Hippocrates, and furthermore from the anatomical and chemical sides a much deeper study has shown a multiplicity of lesions in the brains of individuals suffering from epileptic attacks. These anatomical and chemical findings, well summarized by Munson in White and Jelliffe's large volumes on the *Modern Treatment of Nervous and Mental Disorders* (1913), most strikingly reveal in how many different and various ways the motor pathways in the brain may be involved. Notwithstanding this richness of clinical delineation, and this array of findings on the anatomical and chemical sides, there still remain to be stated some definite functional fundamentals which will render the attack intelligible. A brief presentation of the dynamics of the discharge is therefore essential.

The human organism, like all other living organisms, has built up a rich system of mechanisms to adjust itself to the problem of living. The human varies solely in his richness of contacts and his wealth of reactions. The entire biological series has its culmination in man. Lower organisms are adjusted to simple physicochemical surroundings through a series of mechanisms which have been termed "tropisms." Higher organisms have established interrelations between these tropisms by means of a nervous system which acts through a series of reflexes. Finally all those higher animals have established psychical or mental processes of purposes of socialization. Man, as a social animal par excellence, has built up a rich and varied series of intercommunications and interrelations through his language symbols.

The human nervous system therefore may be viewed as having evolved gradually through a series of ascending phases, which for purposes of description may be limited to three levels: a level of physicochemical adjustments, which is taken care of by the vegetative nervous system (sympathetic in a larger sense), the sensorimotor system (cranial and peripheral nerves), and a physical or mental system functionating by utilization of symbols.

The function of the body as a whole is to transform energy for its own purposes. This energy is the cosmic energy which is derived from the universe and known under a variety of forms, such as heat, light, electricity, chemical action, gravity, etc., etc. It must not be imagined that the only energy that the human body can transform is the chemical energy of food. This is the smallest part of the work done by the human machine, and so far as may now be seen, the food chemicals are chiefly utilized in the upkeep of the machine. The energy, for instance, which was, is, and will be transformed by the Gettysburg speech cannot be computed in terms of Lincoln's breakfast eaten on the day of that memorable occasion.

It is essential to realize in studying the epileptic problem, as well as any other in which motor activity is to be interpreted, that the dynamics of energy transformation is not to be understood solely in terms of the

lowest of man's adaptive levels, that is, the physicochemical or metabolic level. The chief energy transformer at this level is the "hormone"; for the sensorimotor level, the "reflex"; while for the psychical level, the "symbol" is the energy transformer.

Now viewing the human animal from the structural viewpoint and reducing the nervous system to its simplest terms, man may be thought of as consisting of a group of receptors, or receiving organs, whereby he comes in contact with, that is, receives energy from the external world, as outside of himself (exteroceptors) and as part of himself (proprioceptors). The combined material falling upon these receptors must be reacted to in some form and thus there results a series of effectors to carry out the necessary adaptation—(control of nature). These effectors are chiefly muscles, striped and unstriped, working consciously or unconsciously, but other effectors are glands, etc. In the highly complicated organisms, with rich compound reflex systems, such as in man, a host of switchboard connections is developed—relators or connectors. These are, as is well known, extremely complicated and make up the chief mass of the spinal cord and brain.

The old view that the ganglion cells stored up energy, or were repositories of energy or made energy, must be abandoned.

That they have such as an accessory function related to their own maintenance as working structures may be, but they are not to be viewed in the old Leyden-jar analogy sense as independent sources of energy.

Thus the nervous system is to be viewed as a mass of interrelated pathways which, through hormone, reflex, and symbolic transformers, redistribute and modify the energy received for the purposes of the organism.

A well-adjusted nervous mechanism, then, is one that properly and in an orderly fashion can distribute its energy, but an epileptic organism is one, as already pointed out, that is constantly breaking down in its adjustments and that creates disturbances at the various levels just enumerated.

Thus it can be understood that an epileptic attack can more or less limit itself to any one level. It may be all metabolic, or sensorimotor (classical attack), or a purely symbolic attack (psychical equivalent). As a rule, the well-developed attack involves all three levels.

Thus there are so-called hysterical convulsions which involve only the highest levels. From the viewpoint here adopted these are purely psychogenic. The mental or symbolic energy is converted into physical phenomena—the convulsive seizures. The patient escapes from a painful adjustment of his difficulties (energy distribution) through a flight into a lower level—that is, from the psychical to the physical.

The careful student of hysterical convulsions by studying the ef-

fector actions (motions) will be able to determine precisely through what channels the blocking of the energy has taken place and wherein the energy has been discharged in a more diffuse manner.

In the compulsion neurosis, convulsive attacks appear which are of a lower type. They resemble the severe, all-level attacks more closely, but energy discharge is largely through symbolic pathways and hence more psychological in type.

A deeper level type of attack, still psychological, is seen in the so-called "affect epilepsies" emphasized by Bratz. The patients are unable to adapt to intolerable curtailment in their energy distribution, no adjustment seems possible, and they go into a violent series of motor outbursts, clinically indistinguishable from more classical epileptic attacks. Such are seen, for instance, in prisoners locked up for a long term imprisonment, and in soldiers in the Great War unable to get out of an intolerable situation. The wild outbursts of these patients may be accompanied by hallucinations, there is usually complete amnesia, and consciousness is frequently clouded, although not absolutely.

In the classical epileptic attacks the far-reaching disorganization of the energy distribution is seen in the complete loss of consciousness and the still further breaking up of all purposeful or adaptive movements. There is absolute destruction of all adaptations. Destruction is the motto of the nervous system, the channeling of nervous discharge, which Cajal has so beautifully illustrated, whereby the intensity of the energy may be evenly distributed (avalanche action), fails, and total anarchy is the result. The attack involves not only the psychological, the sensorimotor but the physicochemical as well, as seen in the toxicity of the secretions, the alterations in liver metabolism, changes in blood coagulability, in adrenalin content, etc., etc. *These changes are not the causes, as is so frequently urged by this or that student; they are the results.*

As the patient comes out of his attack it may be seen to what low instinctive levels he has been reduced. He shows marked infantile breathing (abdominal type), he makes characteristic sucking movements of the mouth. He at first aimlessly fumbles about and slowly finds himself. Expressed in another way, he recapitulates the series of years of his growing up from childhood to an adult in the few minutes or hours that he takes to rerelate himself to his surroundings.

This comparison with the infantile life casts a light upon the unconscious processes which are going on in the epileptic attack. In this period of infancy it is known how wish-fulfillment by incoördinate movements is perfectly normal. The repressed or thwarted child will cry out, will thrash and stamp and throw himself on the floor, will scream, lose his breath in anger, even become blue. These phenomena are lightly referred to as "fits of temper." Such a child will later throw things on the floor, kick the chairs, tear up his books, spit in one's face, while adults will

go through similar mechanisms when they stamp the floor, clench their fists, grit their teeth, swear and show reactions of anger which are quite uncalculated to effect any real change in the conditions surrounding them. The meaning in all of these phenomena is the inability or lack of desire to accept, that is, to adjust. These individuals are determined that a thing is not so because it cannot be so, that is, they do not wish it to be so. They make a supreme effort to change realities by thinking them different, which, because it fails, forces the energy discharge off into avenues, which cause a flight from the whole affair by rigidity and unconsciousness.

To understand the epileptic attack, then, it becomes imperative to study it from the top down, rather than from the bottom up; from the psychical towards the chemical, rather than the reverse. The first thing to understand is the "psychical defect" side of the problem. The faulty adjustments to reality must be understood from the highest of man's wishes, especially his greatest need, namely, social integration—social conformity. Dynamic psychology has made it an issue that all mental symptoms must have a teleological function. The epileptic attack as well as the epileptic deterioration must be viewed as responding to a need or wish of the patient. His first great defect is his faulty handing of the Œdipus function.

Socially speaking the epileptic tends to belong in a group by himself. His unconscious wish to differ utterly from all others is not sufficiently sublimated, or possibly capable of sublimation, because of gross anatomical defect. Studies on the epileptic constitution by psychanalytic methods have been unanimous in showing the antisocial attitude of the inner trends of the epileptic (Maeder, Clark, Jelliffe, Ferenczi, and others). They cannot recognize, by adequate return, the protection which is offered by the social group. They remain selfish children, expecting everything and giving little or nothing. As MacCurdy well puts it, "the epileptic is, therefore, one born to trouble and bound to hate the world that means trouble to him." In his deterioration he retires from the world, gets to feel that he must be looked after, as he was when a child, and gives little or nothing in return.

Clark has shown a similar situation for the epileptic attack. It usually has its psychical setting. When things are going badly, when the patient is encountering difficulties, when he gets into conflicts and the world is not treating him as well as it ought, then the attacks come on. Again it is a flight from reality, but a flight with all the violent wish of the infant for omnipotence.

When one studies a huge number of attacks, as has been done in some of our epileptic institutions (Clark, 175,000 at Craig Colony), at least two pertinent facts come out relative to ordinary factors of energy distribution. In the first place it is noted that on rainy days, holidays and Sundays the attacks augment. The patients are not busy. The more adequate energy adjustments of the usual routine of life are lessened, or

shut off, and their false application is rendered easier. Again the curve goes up at the cessation of the day—at the beginning of the sleep hour. This, too, is the time of maximum struggle between reality and phantasy.

The epileptic, let his nervous pathways be impeded by what may, a tumor, a scar, a failure of development, a toxemia or any of the two or three hundred different brain lesions which are known to accompany the epileptic attack, is an epileptic, partly by reason of this handicap, which may be non-recognizable or quite apparent, but also partly because he has not learned to wish to conform to those ideas about him which work for the advance of the social body. Recent studies by Ferenczi, Jelliffe, Maeder, and Clark have shown this most abundantly. MacCurdy aptly says of the epileptic—he is speaking of the essential epileptic, or what in this article would be termed the epileptic whose organic handicap is minimal or difficult of recognition—"that when he lets his adaptations go, loses more than what these adaptions gave him. This tendency—that it may progress further in the patient than in the average man—is no stranger to any of us. We all have traces of the epileptic reaction when we give way to temper, choose the easier path, or allow our egoism to sway our judgment. In so far as we have these characteristics, we are liable to the fate of these victims of self. It is ordinarily supposed that the egoist loses only the regard of his fellows when he obtrudes his egoism. But if psychoanalytic studies in epilepsy have no other value, they would be justified in the demonstration they give of the fate of the egoist who loses his mental capacity as fast as he loses contact with the world. The egoist is relentlessly pursued by the nemesis of intellectual degradation. Born social, not solitary beings, our mental capacity seems dependent on our retaining a vital interest in our fellows. The bonds that unite all human beings are not merely essential to the species, they are an integral part of the individual. These lost, the personality, even mentality is lost. To put the matter in lay terms, we must love, not merely be loved; we are under compunction to love or cease to be ourselves, cease even to think." An ancient Greek philosopher said it in another way. "We think alike," said Protagoras, "concerning those things which are necessary to live; we vary concerning those things which are not needed for a bare existence, though they may conduce to a life that is beautiful and good; but it is *only when we do not act at all that we can differ utterly from all others and live our own lives apart.*" The epileptic is hindered from social action, by his fit, because he *wants to differ utterly from all others.*

Therapy

With this simple symptom review, especially of the mental features, with the etiological possibilities and with a brief résumé of the dynamic significance of the attack in view, one is ready to start on the therapeutic problems involved.

Naturally when one glances at the tabular summary on pages 651-652 the suggestion arises that the majority of the particular epilepsies there mentioned either are untreatable or that treatment is of little avail. This is far from being the case, however. In certain of the epilepsies enumerated as due to gross organic lesion the indications for definite therapy are very direct.

Thus, the epilepsies of cerebrospinal syphilis, which latter shows itself in the form of flattened pachymeningeal or leptomeningeal gummata, or as a diffuse infiltrating exudate, or as a specific endarteritis of the terminal vessels of the cerebral cortex—these epilepsies demand prompt antisyphilitic treatment—preferably by from two to five injections of arsphenamin intravenously after a complete neurological and serobiological status has been taken. Most of these syphilitic epilepsies clear up as if by magic. This is true particularly of those cases of infantile cerebral syphilis of hereditary origin, with epileptiform convulsions, and at times with various grades of feeble-mindedness.

While arsphenamin or its related compound has not proved itself to be a specific it is one of the best spirocheticides as yet evolved. In early stages of infection it is most valuable. It is less valuable in later stages. Bismuth salts also offer some advantages.

The epilepsies of brain tumor, or serous meningitis, of chronic bony pressure, of depressed fracture, of cystic formation, of pachymeningitis, and other removable disorders require appropriate surgical teatment. Such surgical treatment is not to be recommended, however, in the absence of definite indications. Indiscriminate surgical therapy for epilepsy is criminal. The chief indications that call for surgical interference are the history of a new growth formation, or of that of an accident, or old injury that might leave residual lesions. A careful neurological status, which points with some degree of definiteness to a particular brain area as being involved, is imperative. Here jacksonian attacks are of extreme importance in determining the advisability as well as the location, also the presence or absence of aphasia, of disturbance of smell—uncinate fits—etc., in which connection it should not be overlooked that new growths of the temporosphenoidal lobes very frequently give rise to very characteristic epileptiform seizures accompanied by hallucinations of smell. Finally, there is the absence of the characteristic serobiological reactions of syphilis—the four phase reactions of Nonne, as they may be conveniently grouped.

Occasionally a general paralysis shows itself first—to the untrained observer, at least—as an epileptic convulsion. A careful neurological and mental examination, with the positive Wassermann blood and cerebrospinal test, a cell count of the cerebrospinal fluid of over ten cells to the c. mm. and positive globulin and gold sol findings point clearly to paresis. The neurological status may be negative, even though less frequently no

mental defect can be made out on the use of the proper "intelligence tests," yet the serobiological tests have been shown to be quite reliable.

At this phase the proper treatment is more legal than medical. While a prompt medical attack should be made upon the disease it is essential that the sick individual should be so guarded as to prevent the dissipation of his property. Although American jurisprudence has not yet advanced to the point that serobiological tests will be accepted as proof of the existence of paresis, the family physician should not neglect his duty in making the interested parties aware of what is likely to happen. He should do all in his power to put legal safeguards in operation to prevent loss and destruction, which are bound to come and, usually, all too quickly. This is preventive medicine of the highest order.

The therapeutic art is dumb in the face of the epilepsies of multiple sclerosis, of tuberous sclerosis, of the various scleroses following encephalitis, etc., so frequently found in the epileptic brain. Here the etiological diagnosis—save for multiple sclerosis—before autopsy is rarely made.

In passing over to the group of the so-called microscopical epilepsies it may again be stated that they are due to definite brain changes, but that these possibly are not always structural changes, or are structural only in the sense of a change in the protoplasmic character of the cells—such as occurs, for instance, in simple toxemic states.

We are not here concerned with the therapy of uremia, nor of diabetes, nor yet of the metallic poisonings, all of which may cause epileptiform convulsions. The diagnosis made, the therapeutic indications are self-evident.

In the group of the epilepsies due to disturbance of the internal secretions science is not yet on firm ground. It may be stated, however, that certain epilepsies exist which are due to defects in metabolism. Munson's able summary shows the present status. Parhon has gathered the evidence from another angle.

It must be confessed that the therapeutic use of thyroid, thymus, ovarian, testicular, and other organic substances has not given many striking results, but this failure may be due to the fact of its indiscriminate use—the failure to select those epilepsies, for treatment by such means, that are due to metabolic defects. Here the obvious difficulty arises: How is one to determine that the epilepsy is due to a loss or surplus activity of one or more internal secretions? It is only by a process of rigid differential diagnosis, a sharp eye open to other concomitant symptoms of disorder of the internal secretion, and their empirical trial.

Thus in the epilepsies observed in castrated women the therapeutic approach is often evident. It is further apparent that there are physiological castrations from ovarian disease in which a like therapeutic attack would be relevant.

The menstrual epilepsies need to be carefully studied along this same line of thought, and the menopause epilepsies as well.

There are frank epilepsies in subacute or partly developed myxedemas. Here proper attention should be given to the thyroid. Thymus disease is responsible for certain epilepsies.

Finally the general problem of the metabolism of calcium should receive attention, especially in its perturbations due to thymus, or parathyroid disease, and also in its relations to the acids of the gastro-intestinal tract. Certain epilepsies show disturbances in the usual calcium interchange, and such epilepsies are much benefited by administration of the calcium salts, or a substance rich in such salts.

General Mode of Treatment

After all is said and done we are still in the position that all the groups of cases, apart from the few that respond to special modes of treatment, arsenic, mercury, iodids, secretion therapy, etc., can be much benefited by general treatment along general lines. These general lines are here indicated at the end of this article, rather than in the beginning, because the epileptic has been too much regarded as a general rather than a special problem. He has been "herded with the bunch," so to speak, and individualization has been too often neglected. He is given bromids, laxatives, and general advice, but is neglected as a scientific problem in individual differential diagnosis.

Prophylaxis.—How far can the various epilepsies be avoided? If the etiological factors referred to in this article are of the importance attributed to them it is seen that the problem of the epilepsies and their prevention extends into the broad fields of preventive medicine in general. Every disease in childhood should receive the best possible treatment, and not even the minor ailments should be neglected, especially if its infectious agent is one that has special affinity for the nervous system. This is particularly true for influenza and for whooping-cough, also for syphilis and alcohol.

What can one answer in regard to the question of marriage? This is confessedly a difficult factor. In those instances in which the epileptic attacks are the result of purely accidental factors, trauma, severe illness, encephalitis, it is difficult to see wherein there can be any inheritance of an acquired character. But perhaps there may be factors behind in the individual which have determined an epilepsy in those who have accidentally acquired it. In this case the presence of an epilepsy determiner would be a serious thing to hand down.

The question can receive an answer only by an appeal to experience. Such appeals in the usual statistical studies have only just begun to be of value. Davenport and Weekes, in their study, have given us the most

searching analysis of this question ever attempted. While it is certain that the material utilized in their study constitutes the worst portion of the community, neuropathically speaking, their conclusions should be carefully considered.

They show from their field study work that such a method for the study of epileptic families, combined with the modern biological methods of analysis of hereditary data, constitutes a vastly improved means of inquiry into inheritance of epilepsy. Epilepsy and feeble-mindedness show a great similarity in behavior in heredity, supporting the hypothesis that each is due to the absence of a protoplasmic factor that determines complete nervous development. When both parents are either epileptic or feeble-minded most of their offspring are so likewise. Other conditions named, migraine, chorea, paralysis, and extreme nervousness, behave as though due to a simplex condition of the protoplasmic factor that conditions complete nervous development, that is, persons belonging to these classes usually carry some wholly defective germ cells. Such persons may be called "tainted." When such a tainted individual is mated to a defective about one-half of the offspring are defective. When a simplex normal is mated to a defective about one-half of the offspring are normal; the others defective or neurotic. When both parents are simplex in nervous development, and "tainted," about one-quarter (actually 30 per cent) are defective. The proportion of tainted offspring is not noticeably higher when both parents show the same nervous defect. Normal parents that have epileptic offspring usually show gross nervous defect in their close relatives. While they recognize that "epilepsy" is a complex, yet they conclude that there is a classical type numerically so preponderant that, in the mass, "epilepsy" acts like a unit defect. They state that their data point to a poisoning in slight degree of germ cells by alcohol, but conclude that the evidence is hardly crucial. That there is evidence that in epileptic strains the proportion of epileptic children in the latest complete generation is double that of the preceding; but there is no evidence that in these epileptic strains the average number of children in a fraternity is greater than in the population at large. The most effective mode of preventing the increase of epileptics that society would probably countenance is the segregation of certain groups of epileptics during the reproductive period.

These conclusions are in need of some modifications. Some of them are not true; thus the epileptic parents may have perfectly healthy children and so may feeble-minded. They are overstated, but the general trend is worthy of attention. Should an epileptic patient come into the office and ask advice regarding the advisability of marriage, the answer should only be made after a complete study of the family trees of both parties involved, and of the individual etiological factors in the case under review.

There are epilepsies of so purely accidental a nature that transmissibility does not take place when the stock is healthy. But it is not always simple to draw the distinction between such a purely fortuitous epilepsy and one that appears accidental, but which in reality has been determined by specific resistance absence factors, the accidental causative factor having made a latent possibility effective. When the contracting parties each have had neuropathic taints the results for the progeny will be apt to be disastrous.

But may not marriage still be considered if conception be prevented? This may be the next form of the question if the physician has offered objections to the marriage of the parties under consideration.

Here other features of an entirely different character enter into the problem. The answer is not simple. In the first place it is not possible always to prevent conception. If conception takes place one is face to face with the question of abortion. The out-and-out eugenist will not balk at the answer. Whether his attitude should prevail may well be made the subject of an extensive discussion, and every physician meeting this problem must consider it on its own ground in the light of all the facts.

Furthermore the method of preventing conception easiest available, that is, the wearing of a condom, is for many individuals extremely difficult. Here a choice of two evils must be fairly put up to the individual with a strong accent on the fact that relative celibacy does one little harm after all. For either party an unsatisfied sexuality runs the risk of the development of an anxiety neurosis. This, however, is a much more readily handled proposition than that of an epileptic child or children.

An examination of the tables of Davenport and Weekes demonstrates that the brothel is no solution of the difficulty. It, in fact, is an enormous element in creating the conditions not only in the epileptic camp, but in that of the neuroses and psychoses in general. Man's subjection to the domination of nature's primal instinct and its forcible determination to the sexual object have created the brothel, and with it many of the problems of neuropathic heredity. Hence we should not look to the concubine nor to the prostitute for help in this question.

That reduces us to the duty of inculcating the principles of the sublimation of man's libido if we are to permit marriage. Such sublimations come about through the avenues of religion, of art, of philanthropic work, of the constructive—not the obstructive—type. The cultivation of the pleasures of the mind so dear to ancient as well as to modern philosophers is one of the necessary features in such a program of efficient sublimation, and is one upon which too much stress cannot be laid.

Nature study is an ever-ready coadjutor in this fight for a balance between the exercise of the sexual instinct and the forces of an eugenic

intelligence. It combines the necessary physical outlet so efficiently cultivated by the Greeks in their gymnastic and out-of-door exercises with the study of those questions of life and heredity which the individual himself is trying to understand and to solve for his own sake and for the good of humanity.

But turning from the problem of averting difficulties to those more imminent, what must be the attitude toward the children of an epileptic father or mother, or of those where epilepsy simply enters as a possible lurking danger? In one sense these children labor under the ban of a possibility, and even a probability, according to the strength of the absence character in the germ plasm of the parents.

For the many in the population of our large cities the problem has no practical solution. One can speak of it, but what can be done? Nothing! Each case, however, may be made the burden of an appeal to one of the philanthropic group in search of his or her own efficient and saving sublimation.

It is perhaps a pretty dream, but one can hope to see a class of philanthropic workers themselves endeavoring to compensate for the families denied them, by reason of the epileptic burden, by occupying themselves with the children of the class just mentioned.

Just what to advise such workers to do has its difficulties. On the one hand, we may stimulate their interest in the epileptic colonies now in operation, or those planned, or those that should be planned. It is not enough to have such colonies—they must be wisely managed. The board of directors, made up, we may in time hope, of individuals keenly alive to the problems, should work with all their energies to increase the equipment, make life a comfort and strive to eliminate the tendency to routinism that settles upon most community endeavors.

From the organization of "Our Lady of Lourdes," in France, one can learn many valuable lessons in organized charity—both what to do and what not to do; for there is an individualization there that is well worth emulating. It would not be impossible to learn the name and obtain the record of every epileptic in a community if there were philanthropic workers who would throw themselves into such a work. Over one hundred years ago all of the mentally disordered were carefully counted and listed in a Bavarian principality of 70,000 individuals, and an attempt made at that time to learn somewhat of the causes of mental disorder. It is not surprising that Bavaria stands as the leader of the work to-day in this same movement.

Such an individualization is the only way to get at a problem of this type, then, after the need is recognized in its details, an efficient utilization of private and state help is possible.

The various state charities societies are doing an enormous work of this nature, and they should be encouraged. Personal experience has led

to the opinion that, like most other institutions in this country, that of the philanthropic workers as well shows diffuseness of effort and lack of central organization. That which the Roman Catholic church has been attempting for years in its systematic plan of apportionment in its work might well be emulated in every large community. Religious and philanthropic workers do too much overlapping. They should all get together, apportion their territory, and each cultivate their own garden, and look after the poor and needy in a much more systematic manner. The physician of the country can help immensely in the epileptic problem by preaching and organizing such unification of methods of dealing with this philanthropic work.

The treatment of the average epileptic should be in a proper institution; in fact, the ideal treatment cannot be carried out elsewhere. This becomes apparent in view of the mental state that has been pointed out. There are certain individuals, it is true, who are able to get along in the ordinary social milieu, but they are in the minority. In consideration of the enormous extension of this symptom group, however, there are a great many such individuals, and our treatment may be divided into several sections.

Prophylaxis of Attacks.—General prophylaxis from the eugenic side has already been considered. Here only the constitutional, hygienic, dietetic sides will be touched upon.

Here marked individualization is necessary. It is necessary to take into consideration the social and economic situations, the character of the work of the individual, and the demands made upon him. It has been known for centuries that emotional excitement and mental overwork are disastrous features for this class of individuals, and Hippocrates taught, what is true unfortunately for a few patients only, that a very carefully regulated life may alone be sufficient to bring about a cure in certain individuals. Such a careful regulation is particularly important in the early stages of the illness.

While some modification in the mode of bringing up these individuals may be necessary it is not required that they give up all intellectual work, stop school, etc. A certain amount of training is very essential, but if attacks mount up in frequency under a full day's work it should be reduced to four, three, or even one hour. The work of the day should be planned with regular work and regular pauses.

If the attacks come on in later years an entire modification of the life plan may be called for. Farming, gardening, poultry, and out-of-door work is in general the class of work best suited to the majority of these individuals—due attention being paid to the disadvantages of the summer's heat and excessive cold, and to the dangers from contact with certain tools, horses, wagons, etc., in case of attacks. Many of the institutions for caring for epileptics have carried out the possibilities of industrial

cures to fruitful ends, and smaller institutions can well model after them. Nothing is worse for the average epileptic than to be sitting around, doing nothing all day. Journeying from place to place, seeing new scenes, etc., is also bad for the average case.

It should not be overlooked that very frequently, in the very beginning of an epilepsy, especially if it sets in stormily with frequent attacks, absolute rest in bed is good treatment.

The dietetic management of the epileptic is an immense subject. Individualization is here again, as elsewhere, the keynote. Bad tongues, much gas, obstinate constipation, visceral pains, headaches, eructations, these are the frequent gastro-intestinal conditions often made worse by unwise or excessive medication. A careful metabolism analysis—in the general sense—is desirable—a carefully selected mixed diet should be experimentally elaborated. Unfortunately chemical research is of less value than actual dietetic observations, which should not neglect the routine of the kitchen and the preparation of the food.

It would be impossible to go into all of the details of such a diet in this article, but since Heberden's day it has been known that, in general, epileptics have fewer attacks on a general vegetable diet than when on a meat diet. This does not mean that such patients should not eat meat, nor that any vegetable is good enough; in fact, experimental evidences shows that certain meats, cooked in certain ways, have no ill effect on some patients, and that, for some, vegetables prove disastrous, especially starchy ones. It must again be stated that much of the gastro-intestinal disturbance is due to drugs, chiefly salty solutions.

Regularity in eating is a *sine qua non;* moderation in eating is equally as important, and deliberation during eating is paramount.

A dietary should be evolved which should give the proper nutritive values, the proper pabulum for the motility of the gastro-intestinal canal, and which should contain those ingredients which the individual best handles, as determined by repeated experiment. The chemical and microscopical examination of the feces is of great help in determining the latter.

The dietary should be mixed. Its cost depends entirely upon the individual. The average epileptic does best on a fair breakfast, a dinner, and a light supper, eaten two or three hours before retiring. Some patients do better on four meals a day, others on two.

A dietary for four meals, which is more available for private work rather than in institutions, will follow the European custom with first breakfast between 6 and 7 o'clock, consisting of weak tea or coffee, toast and eggs; a second breakfast at 11 o'clock with bread, butter, soft cheese (pot cheese, cream cheese), milk and eggs. A dinner at 2 or 3 of soup, meat, fish, vegetables, fresh or canned, and a dessert, chiefly fruits, cooked or raw, depending upon the consistency.

Supper at 7 to 8 o'clock. Rice, milk, with cocoa or a fruit juice.

Psychotherapy.—While common sense will go a long way in adjusting many of the mental difficulties of the average genuine epileptic, it will not suffice. These patients are epileptic as a result of a special way they have found to handle their unconscious conflicts. These epileptics need a psychanalysis and it may be said that nearly all epileptics—even the most organic types—would benefit if they could obtain a deeper insight into the activities of their unconscious.

Physical Therapy.—Hydrotherapy is of great service for many epileptics. It is not curative in any sense, but is one of the general tonic agents that help to raise the level of muscular morale, and permit gradual useful energy expenditure instead of the purposeless fulminating discharge of a convulsion. To hydrotherapy, mechanotherapy procedures may be added with precisely the same object in view.

Systematic manual training is an important physical mode of treatment. The individual capacities and tendencies of the patient should be taken into consideration in adapting means to ends.

The brickmaking, broom-making, printing, carpentering, blacksmithing, and similar industrial occupations, as carried out in many institutions, are ideal goals that make the individual useful, train him for efficient activity, and thus must materially aid in therapy. The development of female occupations should not lag behind that of the men, nor should it include too much needlework or machine sewing.

Pharmacotherapy.—We are not considering the patients for whom special measures are applicable, such as mercury or arsenic in the epilepsies of syphilitic origin. The remedies to be here discussed are used largely for the correction of gastro-intestinal disturbances, or are directed toward the depression of excessive motor activity, in order to reduce, if possible, the number and severity of the convulsive phenomena.

Some attacks may be aborted by the prompt use of amyl nitrite, but in general the remedy is useless, and it is doubtful if anything is gained by such attempts.

During an attack little can be accomplished. The head should be protected, a cork or piece of wood inserted in the mouth to protect the tongue, and, later, when vomiting occurs, the patient should be rolled on the side to avoid a possible suffocation or suction pneumonia.

Of the various drugs in use it is to be insisted upon that they are purely palliative. With the advantages go serious disadvantages. The most efficacious are the bromid preparations. The bromin ion acts as a motor depressant, both on the cortex and spinal cord. It may, therefore, simply put a damper upon disordered cortical functions. It does not alter those functions materially. It may seriously be questioned whether bromids are really not more harmful than helpful. They certainly will prove to be disastrous if given without discrimination and in the routine fashion so frequently followed.

They are, therefore, a last resort, or an emergency brake when attacks mount up in increasing numbers and severity in status epilepticus.

Mixtures of the bromids of sodium, ammonium, and potassium are best given, preferably, in large doses of water.

The amounts are to be determined by the frequency of the attacks. These should be carefully plotted. If occurring with any regular periodicity the drug is best started a few days before the expected onset, run up in fairly good doses, and then abandoned. It is folly to dose a patient day in and day out for attacks occurring bimonthly or even monthly.

In status, or threatened status, the bromids are well combined with opium, chloral, veronal, or other motor depressants. Bromids have little value in the psychical equivalents. They are sometimes useful in quieting excessive irritability, but in general other remedies are much more valuable.

Toulouse and Richer have introduced a modified bromid therapy by eliminating common salt, NaCl, from the dietary, and introducing NaBr in soups, in breads, etc. Certain observers have reported good results, others negative results, and it is uncertain if this idea has proved fruitful or not. Restriction of intake of sodium ions may play a part in the general value of the treatment, and if Ca ions are added the results are thought to be much better. All of this, however, is much in the air at present. One thing is certain: that the reduction of chlorin ions works disastrously in furthering bromid intoxication; hence, if NaCl is to be left out, $CaCl_2$ should be added, or other chlorid, not sodium or potassium.

Bromid preparations have sprung up in great numbers in the last few decades. It cannot be said that any have special advantages. Certain patients do better with one, and others with another, and whether it is to be strontium bromid, bromocol, bromopin, bromolin, etc., will depend upon individual elimination tests.

In all bromid therapy it must not be overlooked that bromid salts are stored up in the body, and that bromin retention with chlorin excretion readily brings about bromid poisoning. Thus when the body fluids become poor in chlorin, and the heart and kidney functions are not active, bromid intoxications appear as general apathy, and dulness, or delirium.

It may be seen from the foregoing that cardiac and renal medication should go hand in hand with bromid therapy. Digitalis, belladonna, chloral, arsenic, water should be utilized freely.

The opium bromid therapy of Flechsig has not borne out the expectations of its founder.

Other remedies suggested have been borax, amylene hydrate, chloretone, zinc, urethane, Solanum carolinense, luminal, trional, and veronal. None are specifics; all may be helpful at times.

From our present viewpoint concerning their multiple causation a serum treatment of all epilepsies, as a general procedure, is nonsense. It

is a remnant of the era when the loose concept of auto-intoxication seemed to explain everything, but in reality explained almost nothing. The gastro-intestinal surgical treatment of epilepsy is also nonsense, if used as a routine procedure.

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HYPERKINETIC DISEASES

CHAPTER XXVI

HYPERKINETIC DISEASES

ALFRED GORDON

CONVULSIVE PHENOMENA AND THEIR TREATMENT

Convulsive phenomena are characterized by irregular, intermittent and variable muscular contractions involving a large area. They may be generalized or localized, and according to the duration they may be tonic or clonic.

In the *tonic* variety the muscular contractions are of more or less long duration, thus producing a rigidity more or less intense. The rigidity may be persistent and fixed, as in tetanus, or it may present successive sudden additional contractions without intervals of relaxation.

Clonic convulsions consist of successive contractions, more or less intense and more or less regular, separated from each other by intervals of complete relaxation.

The two forms (tonic and clonic) rarely occur individually; they usually alternate during the same attack of a convulsive seizure. A tonic state is usually followed by a clonic state.

Clonic convulsions occurring in the limbs present flexion, extension, pronation, supination, etc. In the face the ocular globes are agitated with violent movements in all directions; the facial muscles show all sorts of grimaces. The head is thrown in all directions. The respiratory movements are shallow, brief, and abruptly interrupted. The sphincters of the bladder and rectum may present retention or incontinence.

In *tonic convulsions* the clinical manifestations are different: immobility, rigidity, and fixed attitudes are the characteristic features. The limbs are extended, the hands are closed. The jaws are tightly held together and the face is deviated to one side. The respiratory movements are arrested, producing cyanosis. As to the sphincters, there are involuntary evacuations.

Generalized convulsions are usually followed by profound sleep with stertorous respiration.

Among other symptoms accompanying convulsive states may be men-

tioned: elevation of temperature in eclampsia, in epilepsy, in hysteria, and especially after persistent tonic contractions. Vasomotor disturbances are frequent: vasoconstriction is followed by vasodilatation with corresponding consequences. Special senses are frequently affected: amblyopia and diplopia may be observed. Hyperesthesia and a sense of exhaustion are present. An aura of sensory or of psychic character usually precedes a convulsion. Abundant secretion and excretion ordinarily follow convulsive attacks.[1]

Convulsions usually occur in paroxysms with more or less long intervals. If they repeat themselves very frequently they constitute a "convulsive state." The frequency of the attacks depends upon their cause. In central lesions they are usually frequent. Febrile convulsions last as long as the temperature is high. In neuroses, such as hysteria, the attacks are only occasional.

Varieties of Convulsions

Epilepsy.—For a detailed description the reader is referred to a special chapter. Suffice it to mention here that the disease is encountered in (1) cerebral lesions, such as meningitis, tumors, compression, encephalitis; (2) in infections and intoxications, such as alcoholism, syphilis; and (3) in arteriosclerosis.

Epilepsy usually commences in childhood.

Jacksonian epilepsy is also described fully in a special chapter. It will be only mentioned here that loss of consciousness is not constant. Frequently the patient witnesses his attack, except when the focal epilepsy becomes generalized. This form of epilepsy is always in direct relation to a focal cortical lesion.

Epileptiform Convulsions.—Under this term are understood convulsive symptom-groups presenting the clinical picture of jacksonian epilepsy but being brought on by a cause other than a lesion of the central nervous system. They occur in diseases of a general character and, although they resemble genuine epilepsy, nevertheless they do not present the regularity in the periodicity and the definiteness of the latter. They are irregular, variable and temporary. They occur in acute meningitis and more frequently in tubercular meningitis, meningeal or cerebral hemorrhages; in the course of acute infectious diseases, in rabies, tetanus; in intoxications (lead, alcohol, opium, and its derivatives, ergot, strychnia); in uremia. In the latter there is total absence of aura, there is no biting of the tongue. If the convulsions repeat themselves, the patient remains in a state of coma which terminates in death. Epileptiform convulsions may occur in Adams-Stokes' disease, in which they coincide with the periods

[1] The urine may contain enormous numbers of casts after a severe convulsive seizure.—Editor.

of cardiac arrest. Finally convulsions may be of reflex origin: from irritation of peripheral nerves, of foreign bodies, from nasal irritation, from intestinal parasites.

Eclampsia.—It is a special symptom-group of convulsions occurring in pregnant women or else after the confinement. It is probably due to auto-intoxication being facilitated by a disturbance of renal and hepatic functions. Eclampsia is preceded by somnolence and headache, epigastric pain with dyspnea and vomiting. The convulsive attack consists at first of extreme agitation and of small localized twitchings of the muscles of the face, of the tongue, and of the eye globes. Very rapidly tonic convulsions appear: they are intense and generalized and of a tetanic character. This phase is immediately substituted by clonic convulsions. Eclamptic convulsions are rarely single: the attacks rapidly follow one another.

Fig. 1.—Hysterical Contracture of the Arm. (Gilles de la Tourette.)

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Hysterical Convulsions.—They differ from all other forms by their extreme variability in different individuals and in different provocative circumstances. After a period of excitement with nausea, tremor, and globus hystericus, tonic convulsions make their appearance. They are rapidly followed by clonic movements in which one may observe all sorts of incoördinate movements, such as contortions and passionate attitudes; screaming and a mildly delirious state may also occur.

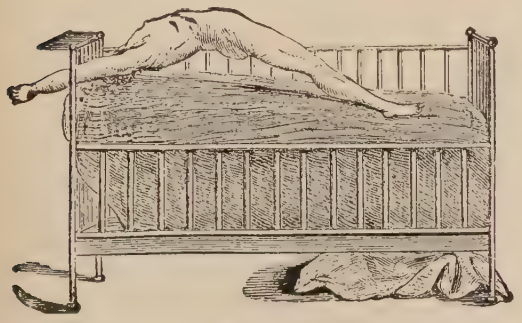

Fig. 2.—Hysterical Paroxysm. Opisthotonos. (Charcot.)

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Hysterical paroxysms occur after an emotion of any character, depressive or exultant. They differ from epileptic attacks by absence of the initial cry, of sudden falling, of biting the tongue, of involuntary micturition. The patient usually seeks a safe position before the attack. Finally a hysterical convulsion may be interrupted contrary to what we see in epilepsy.

Convulsions of Childhood.—Convulsions are frequent in children. Outside of essential or jacksonian epilepsy due to a cerebral lesion, convulsions of infants may occur particularly in tuberculous meningitis. They may also occur during the period of dentition, in gastro-intestinal

disorders, in the beginning of infectious diseases, in helminthiasis, in cases of peripheral irritation (nose, ear, foreign bodies, etc.). Neuropathic children particularly are apt to develop convulsive manifestations apropos of anger, of excitement or of punishment.

Fig. 3.—Passionate Attitude in a Hysterical Attack. (Gilles de la Tourette.)
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The characteristic features of infantile convulsions are: total absence of aura, of initial scream, of biting the tongue; but what is particularly present is the rapid rolling of the eye globes in all directions, besides the movements of the muscles of the face and of the arms. From a recent study of the relationship of convulsions in childhood to epilepsy, J. L. Morse reaches the following conclusions:

"Convulsions which are a manifestation of spasmophilia are not likely to eventuate in epilepsy. Convulsions which occur in the course of whooping-cough must always be regarded seriously, as they are quite likely to be followed later by epilepsy. Single convulsions or a series of convulsions occurring at the onset of an acute disease or with an attack of acute indigestion are less likely to be followed by epilepsy than are repeated convulsions during a considerable period or repeated attacks suggesting petit mal. Repeated attacks suggesting petit mal are just as likely to eventuate in epilepsy as repeated attacks of general convulsions. Nothing can be told from the nature of the early attacks as to the nature of the attacks when epilepsy develops later. When an injury to the head has directly preceded the onset of the attacks or there is no apparent cause for the attacks, epilepsy is more probable than when there is an apparent cause, such as indigestion, for each attack. The presence of an apparent cause for the attacks does not, however, exclude epilepsy."

Fig. 4.—Hysterical Paroxysm. Arc De Cercle. (Gilles de la Tourette.)
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Treatment

Each form of convulsive phenomena is fully described in a separate chapter of the book. For details of treatment the reader is referred to the corresponding pages. Only a general outline of therapeutic indications will be given here.

To treat satisfactorily essential *epilepsy* an account must be taken of all possible pathogenetic factors of the affection. Intoxications, infections, disturbed function of the ductless glands, all must be thought of. Special attention must be directed toward the possibility of acquired or hereditary lues. Even in cases with a totally negative history of luetic infection in the personal and family antecedents, also in cases with a negative Wassermann reaction of blood and spinal fluid, antiluetic treatment should be tried when no other causative factor is discovered. Such is the writer's personal experience. He has seen satisfactory results from such a procedure in many instances. A practical point to bear in mind in all such cases is to commence neo-arsphenamin as well as mercurials with very small doses in order to test individual tolerance. In non-luetic cases the tolerance of arsenical preparations may be less pronounced than in luetic ones. Therefore, in the administration of the drug to the supposedly non-luetic patients (judging from the biological tests), great caution should be exercised with regard to the individual doses.

Besides the usual sedatives and antispasmodic remedies (bromids, luminal, etc.), a description of which is given in the chapter on Epilepsy, most emphatic attention should be given the details of dietetic and hygienic measures. All cases are greatly benefited from strict observance of rules of diet and of mode of living. In some such cases the drugs may even be dispensed with after a certain period of treatment.

In the *jacksonian variety,* in which an organic basis is almost always present, operative procedures are indicated. However, before surgical intervention is decided upon, a trial with antiluetic remedies should be attempted. This trial must be very energetically carried out. Neo-arsphenamin in conjunction with mercurials should be pushed as long as there is tolerance. The writer has seen strictly typical clinical pictures of focal epilepsy cleared up under rigorous doses of neo-arsphenamin.

In *epileptiform convulsions* occurring in the course of general diseases, the etiological factors of the latter should be taken into consideration. In uremia, typhoid fever or other infectious processes, rabies, tetanus, alcoholism, saturnism, etc., in all of which epileptiform phenomena may set in, the original malady is to be treated primarily, since the former is the consequence of the latter. The same therapeutic attitude is to be maintained in cases of *convulsions of a reflex character,* such as from nasal or intestinal irritation. However, in all such cases a question al-

ways arises, whether one deals with a real reflex seizure or with a genuine epileptic attack brought on by a painful exciting cause in an individual who is a potential epileptic. Exclusive reliance on the irritating causative factor is not advisable.

In *eclampsia* the onset, the phase of invasion, namely, the general phenomena (see above) all denote a state of profound auto-intoxication. The treatment, therefore, must be directed towards amelioration of the glandular system, of the kidneys, liver, etc. With the disappearance of the latter disturbances, the convulsive phenomena will gradually lessen in severity and frequency and eventually disappear.

In *hysteria* the convulsive paroxysms, by their mode of onset, by the demeanor of the patient during the attacks, by the character of the movements, by the special state of consciousness, by the manner of the termination, indicate that we are dealing with an emotional discharge, and that the entire condition is of a psychic character and origin.

Psychotherapy, therefore, is the only indication in managing it and in preventing recurrences. It may be practiced in any of its forms; it may be persuasion, suggestion, psychanalysis, etc. It is the personality of the patient that must be reconstructed, and for this psychic methods are of paramount value.

In treatment of *convulsions of childhood* one must not always form a grave prognosis. Before attributing the condition to a cerebral lesion or to an attack of encephalitis which is susceptible to lead to convulsive or paralytic sequelæ, one should always bear in mind the possibility of an infectious process, or errors of alimentation of the nurse and of the infant, of gastro-intestinal disturbances, of the process of dentition, of stimulating beverages (tea, coffee, etc.), of alcoholism in the nurse, finally of some peripheral irritation—all factors capable of producing convulsive phenomena in children. The therapeutic management in all such cases will be carried out according to each of these indications. As a rule there is no way to determine whether a baby having one or several convulsive attacks has at that time epilepsy or will develop it later. It is always wise, however, to treat all such cases as genuine epilepsy.

MYOCLONIA AND ITS TREATMENT

Under the term "myoclonia" must be understood certain groups of morbid phenomena whose common characteristics consist of motor disturbances of convulsive, clonic, tonic, or fibrillary types. Clonic contractions are the most frequent. They are sudden, unsystematized and involuntary. They may be compared to muscular contractions produced by an electric shock. They may be confined to one muscle, to a group of muscles or they may be generalized. Emotional factors and peripheral

stimulation are exciting causes. Fatigue, overwork, traumatism and cold may also be considered as excitants. Middle age is the most favorable period of life and a nervous heredity may be mentioned as a predisposing cause. Raymond considered myoclonia as "a product or an expression of a degenerative state."

Myoclonia may be encountered in the course of various organic and functional nervous diseases. It may be merely a hysterical phenomenon. Many observers believe that the affection is due to an irritation of the cells of the anterior cornua of the spinal cord. Atrophy of the cells of the cortex cerebri has also been observed in conjunction with a localized pachymeningitis (Murri). The researches of Loeb, J. B. MacCallum, W. G. MacCallum, and C. Voegtlin show a certain relationship between various twitchings and calcium metabolism, also with the function of the parathyroid glands.

Within about the last fifteen years special attention has been given the study of the physiology of the corpus striatum and the neighboring tissue in their relation to hyperkinetic phenomena. Anglade, Kolpin, Alzheimer, Wilson, and others described actual lesions in the thalamus, caudate nucleus, lenticular nucleus, and corpus striatum in general. This entire problem has not yet been definitely worked out. It remains yet to determine whether the alterations found in the corpus striatum are of a teratologic or of an inflammatory character; whether they act directly or through an irritation of the pyramidal pathway; whether or not the cortical changes usually found participate in the muscular incoördination.

Before the treatment is considered, various types of myoclonic phenomena will be discussed. The following varieties belong to the group Myoclonia:

1. Paramyoclonus multiplex of Friedreich.
2. Familial myoclonia with epilepsy of Unverricht.
3. Myotonoclonia trepidans.
4. Myokymia.
5. Electric chorea of Bergeron-Hénoch.
6. Dubini's chorea.
7. Fibrillary chorea of Morvan.

1. Paramyoclonus Multiplex.—The muscular contractions are generally clonic but sometimes tonic. They are sudden, lightninglike, involuntary, irregular, and arrythmical. They may affect individual muscles or groups of muscles. They appear first in the lower extremities, but may become generalized. The face is rarely involved. Usually symmetrical muscles on both sides of the body are affected. The muscles of the limbs are more frequently affected than those of the trunk. When in the lower limbs, locomotion is disturbed; when in the upper extremities, the usual occupation is impossible. If the muscles of the pharynx,

larynx, and diaphragm are affected, disturbance of deglutition and of respiration will be observed. The individual muscular contractile shocks follow each other with great rapidity, from 50 to 100 per minute; a hand placed over those muscles will feel their hardening and relaxation so that a sensation of trembling is perceived.

An attack may last from two to fifteen minutes and leaves the patient in a state of exhaustion. They may occur several times a day. They do not occur during sleep. Sometimes they are arrested or lessened by a voluntary effort although a cutaneous stimulation, compression of the quadriceps femori or percussion of the patellar tendon may disturb the muscular system and bring on an attack. The nutrition of the muscles as well as their electrical reactions are intact. Sensations are normal. The reflexes are increased.

The general health is usually affected: asthenia, rapid fatigue upon the least exertion and lassitude are present.

The disease is progressive and its onset is insidious. It may last indefinitely. Cases of recovery have been reported. Recurrences are very frequent.

2. Familial Myoclonia with Epilepsy (Unverricht's Type).—Paramyoclonus multiplex presents sometimes a familial character and is associated with epilepsy. Unverricht, in 1891, described such an occurrence in five brothers and one sister whose father was alcoholic and in 1895 he reported the histories of three brothers of another family, all affected in the same manner. Since then a number of writers have reported similar cases.

The epilepsy in this affection may occur early in life and then disappear to be substituted by myoclonic twitchings, or else it may accompany the myoclonia. Myoclonic twitchings are not infrequently associated with epilepsy outside familial cases. They may occur a few days before the convulsive attack; they may occur even in sleep; they may affect the musculature of the entire body. They may be considered as a larvated form of the epilepsy itself.

As to the nature of paramyoclonus, it is accepted by many as a nosological type. Hysteria may sometimes produce myoclonic phenomena very similar to the paramyoclonus multiplex. There are good reasons to consider the paramyoclonus in the category of the tics.

3. Myotonoclonia Trepidans.—Under this name Oppenheim and Popoff describe a symptom-group consisting of a tonic contraction of the muscles (cramps) followed or accompanied by myoclonic twitchings and tremor. Either of these three manifestations may be particularly pronounced. The condition is never observed at rest, but only upon active movements. Upon the least attempt to move or to displace the affected part muscular contraction sets in. Of the three symptoms the most constant is the tonic phase. The disorder is not confined to one individual

muscle but it frequently extends to other neighboring muscles. The lower extremities are most frequently involved and the quadriceps femoris is the usual seat of the morbid condition. The patient usually complains of general weakness, difficulty of walking, pain in the back, headache, cardiac palpitation, insomnia and irritability. The patellar tendon reflexes are ordinarily increased. Trauma is the most frequent cause. Emotional factors, infectious diseases and alcoholism are also sometimes followed by the disorder. Neuropathic constitution is a predisposing element.

Oppenheim places the affection among the neuroses similar to hysteria or neurasthenia.

4. Myokymia.—It is characterized by continuous fibrillary contractions. The muscles of the extremities are most frequently involved although other parts of the body may be also affected. Sometimes pain and hyperhidrosis accompany the muscular twitchings. In one of my cases myokymia of the right lower half of the face was associated with myoclonia of the upper half of the face. The least mechanical irritation increased the twitchings. The affected muscles presented a decreased faradic and galvanic irritability.

5. Electric Chorea (Bergeron-Hénoch).—As in paramyoclonus the principal symptom consists of sudden involuntary muscular twitchings rapidly repeating themselves. They differ from those of paramyoclonus by greater violence, they are less symmetrical and not synchronous, so that twitchings may occur in muscles which cannot contract voluntarily. When electric chorea affects the muscles of the neck, it should not be confounded with torticollis in which the muscular contraction is of much longer duration.

The twitchings are so abrupt that they appear to be the effect of an electrical discharge repeated in a rhythmic manner. They may affect any portion of the body and the impression produced depends upon the muscular area involved. They occur symmetrically in the same muscles of each side of the body. The respiratory muscles may also be involved. Any attempt to control them increases their intensity. They disappear during sleep. Generally speaking, the movements are so frequent and intense that the patient is obliged to give up his work. In spite of the contractions the power of the muscles is preserved, sensations are normal and the electrical reactions are not altered.

The disease occurs almost exclusively in children of from seven to fifteen years of age. A neuropathic history has frequently been revealed, so that isolation and psychotherapy give good results. The outlook is usually good. The disease is of long duration and its termination is like the onset, namely, rapid.

In a number of cases the disease was associated with gastric disturbances, and improvement of the latter was followed by disappearance of

the muscular twitchings. Auto-intoxication is therefore supposed to be the cause of the affection. In some cases the symptoms are a manifestation of hysteria.

6. Dubini's Chorea.—By its manifestations it resembles the electric chorea of the preceding chapter, but by its course, duration and termination it differs.

The onset is abrupt, sudden, and is accompanied by intense pain in the head, neck, and lumbar region. The twitchings are rapid, appear first in the upper extremities and soon spread. They occur at regular intervals and not infrequently are accompanied by convulsive seizures without loss of consciousness. Fever is also present in the majority of cases. General sensibility and electrical reactions are not affected.

The disease is progressive. Gradually the twitchings and the convulsive seizures increase in intensity and frequency, a comatose state supervenes and death follows. The duration of the affection is from several days to five months.

The sudden onset, the pain, the accompanying fever, and the associated pulmonary disorders (which are quite frequent) are in favor of an infectious origin of the affection. Postmortem investigations have shown in a number of cases congestion and inflammation of the meninges and of cerebral tissue, also increase of cerebrospinal fluid.

7. Fibrillary Chorea of Morvan.—This affection, like the electric chorea, is characterized by involuntary contractions but unlike the latter the clonic movements are here reduced to a minimum. The contractions appear first in the muscles of the posterior aspects of the thigh and legs; they gradually extend to the trunk and upper extremities, but the face and neck are very rarely involved. The twitchings never affect an entire muscle, but only isolated muscular fasciculi, so that a slight tremor or a slight elevation of the muscle is seen during an attack. The patient's activity is therefore not interfered with.

The disease occurs in the adolescent period of life. Excessive work is frequently the exciting cause. Nervous individuals are most frequently affected. The outlook is favorable. Recovery is certain, but recurrences are frequent.

Treatment of Myoclonias

In a discussion of the therapeutics of myoclonia all possible pathogenetic phenomena should be considered. It was mentioned above that experimental investigations have shown a certain relationship between muscular hyperkinetic phenomena and the calcium metabolism, also the function of the parathyroid gland.

The rôle of calcium in the organism has been studied from the standpoint of its absorption, its assimilation, its excretion, and with regard to disturbances affecting various stages of its metabolism. Calcium among

many functions is of paramount importance in the regulation of normal muscular excitability, and among the organs which normally contain the largest amount of calcium the brain is in the first place. Calcium is a necessary alimentary element. In case of an insufficient supply the calcium of the cerebrum diminishes. As to the metabolism of calcium, the endocrine glands—parathyroid, thymus—and the vegetative nervous system play a large part in it.

Parathyroidectomy is frequently followed by muscular twitchings which are the consequence of a calcium deficit in the central nervous system: it has been shown that the calcium content in the brain and in the blood of cases of tetany is diminished (MacCallum, Neurath, Stheeman, Trendelenburg, and Göbel). The serum of a cat rendered tetanic has the same paralyzing effect on the heart of a frog as a fluid deprived of calcium; and if calcium is added, the inhibitory action disappears, and the tetanic serum recalcified becomes equivalent of the serum from a normal cat. MacCallum believes that parathyroid secretion governs the conversion of a non-diffusible and physiologically useless combination of calcium into a diffusible form which is essential in maintaining the control of the excitability of the nervous system; the fundamental product in the excreta is lost and not formed anew in the absence of parathyroid secretion.

In view of these experimental data the use of calcium salts and of parathyroids is directly indicated. As to calcium, its administration has the best chance of exercising its full therapeutic action when given in intravenous injections which is the best method of increasing the calcium content of the blood. The reasons for the latter are the following: Calcium is found in the blood in three forms: (1) free ion calcium; (2) non-dissociated salts; 3) non-diffusible calcium incorporated into albuminoid molecules (25 per 100 of the total calcium in the blood). The content of ion calcium is maintained remarkably constant by means of a regulating mechanism which appears indispensable to vital phenomena (Hamburger and Brinkman).

Besides the intravenous administration, calcium may be given by mouth. The lactate taken for a prolonged period of time has proved to be useful in the hands of the writer and especially when combined with small doses of parathyroid. Occasionally thymus has been added or substituted for the parathyroid. Calcium in such cases is well tolerated even in children. It is well to commence with 2 gr. of calcium lactate in children and 4 gr. in adults. Instead of increasing the dose, I find it of greater advantage to increase the frequency of the same dose.

Sedatives (bromids, chloral) or coal-tar products are sometimes of advantage. Arsenic has been advised. Atropin, eserin, valerian, hyoscin and cocain have been used with varying results. Thyroid gland tablets (1 to 3 daily) are supposed to be occasionally effective. When the con-

dition is only a symptom of other diseases, the first indication is to treat the latter. As in the majority of cases myoclonia develops in neuropathic subjects, much attention should be given to the general health. Hydrotherapy only of moderate temperature, moderate exercises (avoid violent movements), regularity in the mode of living, avoidance of excesses and of stimulants (including tea and coffee), avoidance of excitement and worry, nutritious food, all are essential. Confinement to bed is an excellent procedure to begin with. Finally galvanism of a mild current and also static electricity have been advised by some writers.

Hyperkinetic phenomena do not in every case have a purely physiologic basis. Indeed in certain instances they may be only of psychic origin. In such cases a psychogenetic factor should be sought after. The psychanalytic method will render considerable aid. The reader is referred for these considerations to the chapter on Treatment of Tic.

SPASMS AND THEIR TREATMENT

Under the term "spasms" are understood well-limited, systematized, persistent, and confined to the same area contractions of voluntary muscles. They may accompany (*a*) *irritative lesions,* in the central or more frequently in the peripheral nervous system, as, for example, preceding or following facial palsy. They may be of (*b*) *reflex character,* frequently localized in visceral muscles, such as pharyngeal, pyloric, rectal, vesical, etc. They may be produced by (*c*) *local ischemia,* such as we observe in intermittent claudication through an angiospasm. They may be (*d*) *toxic,* such as we observe in uremia or in cases of extreme fatigue. They may be (*e*) *traumatic.* They may occur in infants, such as spasm glottis, in whom there is a hyperexcitability of the neuromuscular system and known under the name of (*f*) *spasmophilia.* Finally spasms may be a (*g*) *hysterical phenomenon.*

Facial Spasm

Spasm of the face commences with clonic contractions which, as they advance, gain in rapidity and at the height of the attack are replaced by tonic contractions. As the latter subside, clonic contractions reappear and remain until the attack is over. The entire cycle lasts but a minute. During the paroxysm the forehead on the affected side is wrinkled, the orbicularis palpebrarum closes the eye. The zygomatic muscles deviate the angle of the mouth. The nose is curved toward the affected side and the chin presents a characteristic depression on the affected side. The muscular contractions may be either fascicular, tremulous, or coarse. The muscles involved in facial spasm correspond to the well-defined ana-

tomical distribution of the seventh nerve. No effort of will is capable of arresting or preventing an attack. Facial spasm occurs during sleep. It may be unilateral or bilateral. The stimulation of the muscles supplied by the seventh nerve may originate in the nerve itself, or in its nucleus or else in any of the sensory fibers of the fifth nerve. It may also be observed in organic lesions of the central nervous system (meningoencephalitis, pseudobulbar palsy, disease of the pons).

Treatment of Facial Spasm.—If a local cause of irritation can be detected its removal is necessary. Freezing of the face on the affected side has been recommended by S. Weir Mitchell. The most effective method of treatment is an injection of a few minims of 80 per cent alcohol into the nerve at its exit from the stylomastoid foramen. It has given me the most gratifying results. The spasms ceased for periods ranging from eighteen months to three years. The facial palsy which immediately follows the injection disappears at the end of five or six weeks in every case. In some cases returns of spasms were treated with repeated injections. The seventh nerve, being essentially a motor nerve, does not undergo pathological changes from the injected alcohol, as an experimental study on dogs has shown (Gordon). In case of double facial spasm the injection should be made into each nerve separately and only after the palsy has disappeared on one side. Alcoholic injections into the seventh nerve may be tried even in cases of organic diseases of the central nervous system.

Fig. 5.—Facial Spasm, Left Side.

The injections via the stylomastoid foramen are associated with a certain amount of danger because of the close proximity of the jugular vein (about 0.5 cm. separates the point of the needle from the vein). To

obviate this risk G. M. Dorrance devised the following method: A needle 10 cm. long and 0.4 cm. thick is inserted at the angle of the jaw (the skin having previously been painted with 5 per cent tincture of iodin and anesthetized with 0.5 per cent novocain), and directed backward and upward until the point impinges on the base of the mastoid. The handle of the needle is elevated and the point is depressed, the operator pushing the point backward and inward until the needle feels its way into the stylomastoid foramen (usually about 5 cm.). If no bleeding occurs a few drops of alcohol are injected. If the nerve is hit successfully immediate facial paralysis occurs.

Fig. 6.—Left Facial Palsy Induced by Injection of Alcohol Into the Facial Nerve.

Torticollis

It consists of a sudden rotatory movement of the head accompanied by flexion or extension. The face is turned to the opposite side, the head is inclined on the same side so that the ear touches the shoulder. This fixed position of the head is due to a spasm of the muscles of the neck, more particularly of the sterno-cleidomastoid muscle. When the upper part of the trapezius and splenius muscles are also involved, the head in addition to being inclined is also drawn backwards.

The patients frequently complain of pain or of a drawing sensation in the neck.

Two types of torticollis are to be considered:

Spasmodic Torticollis.—It is met with usually in adults. Between the spasmodic crises the head is ordinarily inclined to one side. An at-

tack occurs suddenly and then the involved muscle keeps on contracting slowly but continuously, fiber by fiber, fasciculus by fasciculus, until the head assumes the above-described position. Rigidity and pain are present. An attack lasts from a few seconds to one minute. It occurs several times a day and in grave cases very often, so that one attack may follow another in a few minutes. The affection is usually tenacious and may resist all treatment. In rare cases cures have been reported following surgical intervention.

Mental Torticollis.—It was described by Brissaud, Meige, and Feindel. They considered the affection as a psychoneurotic disorder. It is very analogous to the spasmodic type. The deviation of the head is carried out either in clonic or tonic movements. The tension of the head may last a long time.

Fig. 7.—Recovery from Facial Paralysis.

Very often with each movement of the head there is also an elevation of the shoulder. There is usually no pain. What gives the condition a psychic character are the defense movements: very often a slight application of the finger to the chin, thus producing a counterpressure, will prevent the deviation of the head during an attack. It is therefore evident that the torticollis is the result of an irresistible desire to turn the head and that the will may correct or prevent it.

Although a psychic element is sometimes present in torticollis, it should be considered only as a predisposing factor. The majority of observers have at present abandoned the purely mental conception of torticollis. Radiographic studies, our present knowledge of the function of corpus striatum, its manifestation as a sequela of epidemic encephalitis and finally the case of Babinski lead to the conception of two pathogenic

possibilities of torticollis: one is the osteo-articular theory of Marie and Léri, who found lesions in the cervical vertebræ (C5 and C6) consisting of bony neoformations which irritated the roots at the level of the intervertebral foramina; the other view is mesocephalic or central according to which the irritation is due to a primary lesion of the automatic centers of the neck.

In cases of congenital torticollis excised portions of the contracted muscles have shown the waxy degeneration of Zenker, which consists of a sclerotic interstitial myositis culminating in a more or less hardening of

Fig. 8.—Spasmodic Torticollis. Patient seen in attempt to correct position of head.

the muscles with a subsequent shortening. Volcker believes that this peculiar muscular degeneration is due to an ischemia of the sternomastoid muscle, which may be caused by anomalies of position and size of arteries.

Finally, torticollis may be functional, in which spasmodic contractions occur after repeated and well-determined muscular movements. It is met with in tailors, writers, etc. It is analogous to occupational affections, such as writers' cramp.

In *hysteria* a frank torticollis may be observed.

Treatment of Torticollis.—Rest, physical and mental, decreases the intensity of the spasmodic contractions, while fatigue and emotions intensify them. Therapeutic indications are therefore evident.

Reëducation of movements of the neck and psychotherapy may be of service in patients with a neuropathic make-up. Operative procedures have been attempted in spasmodic torticollis. They consist of excision of a portion of the spinal accessory nerve on the affected side and of section of the posterior primary divisions of the upper cervical nerves on the opposite side. I have seen failures from this operation.

For congenital torticollis the following methods may be employed: manipulation, the use of mechanical appliances and surgical intervention. As to manipulations, the position of the head is corrected and maintained by means of a support (plaster of Paris or others). Appliances should be of such a character as to permit their frequent removal for manipulations. Surgery should aim at severance of all tendons or fibrous bands holding the head in a fixed position; the following operative procedures have been advised by Lorenz, subcutaneous tenotomy, myorrhexis and forced manipulations with rotation in all directions. Some surgeons report fatal results from this overcorrection. Open operations are more advisable: the sternomastoid muscle is severed at its sternal and clavicular portions. Some advise also cutting the middle portion of the muscle, but this is dangerous in view of the important blood-vessels lying in contact with its under surface. Mikulicz obtained good results from total extirpation of the sternomastoid muscle. Severance of the mastoid insertion of the muscle has also been practiced by some surgeons. The after-treatment should consist of maintaining overcorrection for several months. Good results have been reported from any of these methods of procedure. Simmons recently reviewed the literature and found 64 per cent of the cases positively cured. Spasm in general and the so-called mental torticollis particularly may find their explanation in the modern conception of the complex factors constituting the personality. Abnormal motor reactions may be considered not only from a physiological point of view but also, and in some cases exclusively so, of a psychogenetic origin, as an expression of repressed forces.

The reader is referred to the chapter on Treatment of Tic.

Progressive Torsion Spasm

(*Dystonia Musculorum Deformans*)

Ziehen and Oppenheim described a symptom-group characterized by a disturbance of muscle tone, which the first writer considered as a functional, the second as an organic disease of the nervous system. The main features of the disease are: a deformity about the pelvis and spasms of the muscles surrounding the pelvis, also twitchings in other muscles. The twitchings are evident while standing or walking, but not in a lying position. The deformity, which is persistent, consists of a marked lordosis

of the dorsolumbar region with a lateral inclination of the pelvis. The gait resembles the movements of a quadruped. When the patient walks, he is affected with movements of a clownish character; the fatigue and strain caused by such movements bring on perspiration and rapidity of pulse. The muscular twitchings are either a rhythmical tremor or rhythmical clonic contractions, especially in the lumbo-abdominal muscles. Tonic contractions are seen especially in the upper extremities. On passive movement a distinct hypotonia is observed even in the muscles which are affected with tonic contractions. The movements resemble those of chronic chorea or rather double athetosis. The tremor resembles that of paralysis agitans.

The reflexes, sensations and sphincters are all intact. The disease occurs in children from eight to fourteen years of age, especially among Hebrews. It is invariably progressive in its course, although occasionally a slight improvement or remission may be observed, but this is always of short duration.

As to the pathogenesis of the affection, the majority of writers (Oppenheim, Hunt, etc.), regard it as an organic disease of the central nervous system. The works of Vogt, of Wilson, and of Hunt have shown that the smaller cells of the corpus striatum exercise a coördinating and inhibiting influence on the large motor cells of the globus pallidus system and, when this inhibitory function is lost, there result many of the symptoms of dystonia musculorum.

Treatment.—Since it is probably an organic disease of the central nervous system, therapeutics are of no great benefit. However, some writers following Ziehen are still of the opinion that dystonia is a functional nervous disorder. It is well not to neglect psychotherapeutic measures with avoidance of all possible stimulating and exciting factors. Reeducation movements should be insisted upon, as some observers obtained satisfactory results in certain cases. J. Fraenkel treated some of his cases with intraspinal injections of magnesium sulphate.

Myospasm from Intense Heat

This condition was first described by Edsall and later by Cameron. In working men exposed to intense heat (140° to 235° F.) a very painful tonic spasm of the muscles develops spontaneously or upon the least voluntary effort. An attack lasts from half a minute to a minute and occurs very frequently during the illness which lasts about twenty-four hours. A sense of exhaustion and soreness with tingling in the muscles remains for some time. Between the individual spasms a fibrillary contraction of the affected muscles is distinctly noticeable. The muscles of the forearms and legs, also the abdominal muscles, are usually involved. The mechanical irritability of the muscles is increased. Reflexes, sensations, sphincters and pupils are intact.

The disease is serious, as fatal cases have been reported. They may have been due to a spasm of the heart muscle. The nature of the disease is unknown. Disturbances of metabolism have been suggested.

Treatment.—It is only symptomatic. Pain may be relieved by the usual remedies or by a general anesthetic. A mild interrupted faradic current gave Cameron some satisfactory results.

Spasmophilia

An overexcitable weakness of the nervous system is responsible for spasmophilia in young children. There is a constitutional inferiority of the nervous system. An asthenic habitus can be plainly detected in the spasmophilic child, as well as in the easily fatigued adult. The vegetative and vasomotor spasms in older children are the equivalent for tetany of younger children. As to the pathogenesis of the condition, an abnormally low calcium content of the blood seems to accompany spasmophilia and to be found exceptionally frequent with the nervous, peptic and trophic disturbances of older children and adults. Stheeman tabulates the findings in 53 children from early infancy to fourteen years old; in 23 with abnormally low calcium content in the blood 4 had pronounced tetany and all the others belonged to the group of constitutional spasmophilic asthenia in children of all ages.

Very frequently there is a familial character in spasmophilia. Pincherle and Pollidori report 91 examples of which a familial factor was evident in 25, that is, in over 25 per cent. In some the spasmophilia was latent and required special tests to bring it into evidence. In some families alcoholism or grave constitutional diseases or neuropathic stigmata were manifest in parents. Rachitis, status lymphaticus, adenoids, or merely enlarged glands often accompanied the symptoms of spasmophilia. The authors suggest that the whole thyroid and thymus system may be below par. In Fiore's case hypertrophy of the thymus occurred in a pronounced form in parent and child.

Treatment.—The calcium problem (see above) leads to the logical deduction that means must be found to arrest the demineralization of calcium in the treatment of spasmophilic asthenia. Calcium given internally overcomes the spasmophilic phenomena but, as soon as it is discontinued, the condition returns. Blühdorn tried to overcome this by giving large doses of calcium, 4 to 8 gm. per day, until the symptoms disappeared, and then smaller doses, about 3 gm., for months afterward. Experiments by Vorhoeve have shown that in adults, as long as calcium was being given, it was stored in the body in increasing amounts, but that, as soon as its administration was discontinued, the stored-up calcium was gradually eliminated. Birk and Shabad's work has shown that phosphorized cod-liver oil has a specific calcium-retaining effect.

Rohmer, therefore, used such a combination in 8 well-studied cases of spasmophilia with rapid and permanent results. According to Stheeman magnesium and strontium act like calcium and his tabulated data show in every case but one the return toward normal content of the blood under phosphorus treatment. Any infection, intestinal trouble, etc., should, of course, be given proper treatment. With chronic dyspepsia, the diet must be scrupulously individualized, remembering that children with chronic constitutional intestinal disturbances do not thrive on much milk. With rachitis, likewise, a milk-poor diet is very important.

Spasmophilia, as well as other hyperkinetic phenomena, should also be considered from the viewpoint of the modern conception of instinctive and emotional life, of the forces involved in the interplay between the subconscious and conscious realms. Mere physiological interpretations of such phenomena are not adequate in every case. The reader is referred for further details to the chapter on Treatment of Tic.

CHOREA AND ITS TREATMENT

Under this term is understood an affection characterized by involuntary, irregular and incoördinate rapid movements of great amplitude. Choreic movements assume a different aspect according to the portion of the body involved. When the upper extremity is affected, the patient is unable to take hold of an object and keep it for a certain length of time, is unable to feed himself, to write. In the attempt to approach his hand to an object, a series of incoherent movements will be produced before the hand reaches it. The fingers separate, approach, flex, extend. The entire limb supinates, pronates, is abducted or adducted. The shoulder is raised, lowered, thrown backward or forward. The leg is in constant motion, moves in every direction when the patient is at rest. The toes flex, extend, the foot turns inward, outward, the legs bend or extend. These unforeseen movements interfere with the patient's gait; he oscillates from side to side; station is equally difficult. When seated, the patient crosses his knees, abducts or adducts them. The neck muscles carry the head in all directions. The muscles of the face are in constant motion, changing its expression continuously: from pleasure or joy to sadness or terror. The eyes open and close, roll in all directions. The lips pout. The tongue is continuously moving from side to side, forward and backward. The involvement of the lips, tongue, pharynx and larynx produces difficulty of deglutition, respiration, and speech. Ziemssen observed with the laryngoscope irregular movements of the vocal cords. The heart muscle may become involved and arrythmia will be the consequence.

Choreic movements persist during the waking state but cease in sleep.

Voluntary movements, emotion, excitement increase the twitchings, but sometimes they have an inhibitory effect.

Sensory symptoms may be present in the form of paresthesiæ or tenderness of the muscles. Objective sensibility is ordinarily diminished.

W. Gordon observed the following phenomenon: In testing for a knee-jerk when the patient is in dorsal position, the leg will at first respond normally in the first phase, but instead of coming down immediately it will remain suspended in the air for some time and gradually come down. It is probably due to a prolonged contraction of the quadriceps muscle.

The pupils are often dilated. The pulse is rapid and quite frequently a mitral lesion is noticed. Urea is increased. The mental faculties are sometimes involved. Dulness, diminished attention, weakness of memory, excitability or else depression are not infrequent. In exceptional cases delirium with hallucinations may develop (chorea insaniens).

Forms of Chorea

Sydenham's Chorea.—This is the classical form just described. It occurs almost exclusively in childhood and adolescence, namely, from six to fifteen years of age, and in girls oftener than in boys. After the menses appear chorea is exceptional and is usually of an hysterical nature.

The onset may be rapid or gradual. The former follows an emotion. In the majority of cases the symptoms develop gradually. A few prodromal manifestations precede the appearance of the symptoms. The child becomes irritable, restless, and awkward movements are soon noticed in the arms and legs.

The disease may affect only one side of the body and it is then called "hemichorea." When there is a marked weakness or a paretic condition of the extremities, it is called "paralytic chorea." The latter may be generalized or confined to one or two extremities (monoplegic, hemiplegic, or paraplegic forms). In a certain number of cases, however, there are slight evidences of cortical or pyramidal involvement (gait, reflexes, incoördination, lymphocytosis, etc.).

In the grave variety of Sydenham's chorea the twitching continues even in sleep and is very violent. Mental disturbances are present and death is the usual termination.

Chorea of Pregnancy.—It occurs usually in primiparæ during the first half of pregnancy. The muscular twitchings are very severe and generalized, involving the muscles of deglutition and of respiration. It is frequently complicated by fever, cardiac disease and mental disturbances. Death is frequent. However, amelioration may follow after the delivery but the mentality may be permanently involved.

Hysterical Chorea.—It usually commences suddenly following an emotion, especially fear. Not infrequently it develops through imitation especially among children in school. The movements are usually so similar to those of Sydenham's chorea that a differential diagnosis is impossible except from the history of the case. Sometimes the involuntary movements are rhythmic.

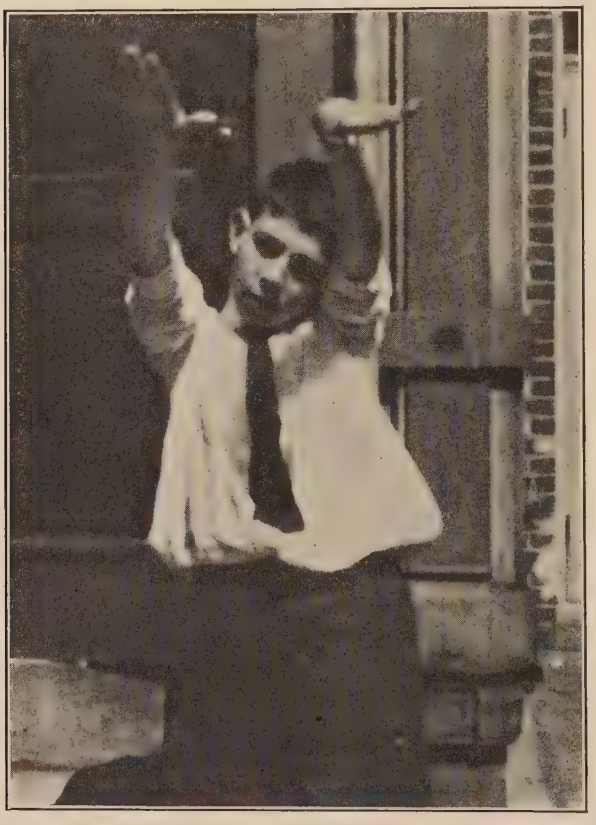

Fig. 9.—Sydenham's Chorea. Note position of hands, head and trunk.

Choreiform Manifestations in the Course of Acute Diseases.—In the course of infectious diseases, such as measles, scarlatina, erysipelas, typhoid fever and tubercular meningitis, choreic movements have been observed. A case of chorea has been reported in the course of secondary syphilis.

Infectious diseases, among which acute inflammatory rheumatism occupies the first place, are not infrequently accompanied or rather followed by chorea. The bacteriological investigations, especially by Pianese, favor an infectious origin of chorea. He found in the spinal cord a bacillus with the cultures of which he made successful inoculations. Poynton and Paine isolated from the cerebrospinal fluid a diplococcus which after an inoculation into a rabbit produced muscular twitchings. The diplococcus was found in the pia mater and brain in choreic patients and in the rabbits. Lymphocytosis in the cerebrospinal fluid has been found in a number of cases. In 1910 I reported cases of chorea which developed subsequently to a localized inflammatory focus.

During the epidemic of encephalitis lethargica chorea has been observed in the same patients, facts pointing to an infectious agent of chorea. Autopsies (Hydovernig and Fiore) have shown disseminated

encephalitis, most pronounced in the optic thalamus and in the motor cortex.

In a number of cases syphilis has been the cause of chorea. Milian reported 15 cases in which stigmata of hereditary syphilis were present, and in 8 out of 13 the Wassermann reaction was positive.

Fright, emotion and traumatism are frequently the immediate causes of chorea, especially in predisposed individuals. Charcot and Joffroy were of the opinion that in chorea there is an inherent degenerative predisposition of the motor apparatus which is brought into evidence as soon as some special cause disturbs it. The present trend of opinion concerning the pathogenesis of chorea is that, after having been considered as a neurosis, it passed from the domain of functional pathology into that of organic pathology and for the following reasons: patients show signs of organic involvement of pyramidal or cerebellar systems, the attitude of the limbs in choreic individuals resembles strikingly that of decerebrate animals or that of patients whose pathology is identical to that observed in experimental decerebration. In a recent case of chorea a detailed microscopical study of the entire central nervous system was described by G. Greenfield and J. M. Wolfsohn.

Treatment of Acute Chorea

The first indication is to take special care of the general condition of the patient. Whenever it is possible, rest in bed is one of the best adjuvants. Good sleep and nutritious food in moderate quantities are essential. Red meats and stimulants, including tea and coffee, should be avoided. Anemia or any other constitutional disorder is to be combated by appropriate therapeutic means. Mental strain and emotions of any violent character should be removed. Hydrotherapy, in the form of tepid baths once or twice a day, is an excellent sedative for an irritated nervous system.

Among all medications the following may be mentioned as having some value in chorea; arsenic, bromids and antipyrin. The administration of arsenic should commence with very small doses and be only very gradually increased as otherwise intolerance will be exhibited very early. An average child of ten should be given at first 3 minims of Fowler's solution three times a day; the dose should be increased very gradually until it reaches 10 drops and for older children 12 drops. Arsenic is usually well borne by choreic patients. It must be discontinued upon the appearance of symptoms of intolerance (diarrhea, conjunctivitis, herpes). Gheroghian and Pepesco report cases cured by intravenous injections of 5 per cent sodium cacodylate solution. At first only 0.10 gm. should be given, and the dose is to be increased by 5 cg. until it reaches 0.65 gm. The daily dose should never reach above gm. 1.20. Bromids, especially the

sodium or strontium salt, should be given conjointly with arsenic. After a week of bromid treatment, it should be substituted by antipyrin, commencing with very small doses. Sodium bromid is preferable to any other salt of bromid as it is best tolerated by the stomach. Bromids may alternate with antipyrin. Arsenic should be continued with either of these two drugs. When there is a history of rheumatism, salicylates, aspirin, or salophen may give satisfactory results. Among other drugs chloral hydrate is to be recommended for controlling the twitchings when other remedies fail. R. Mathieu obtained very gratifying results from sodium hyposulphite, of which an adult may take as much as 4 gm. daily.

In chorea of pregnancy artificial delivery may be considered. The latter should be undertaken when the indications are strong, namely, when life is endangered by exhaustion, cardiac or renal lesions or mental disturbances.

The researches of Loeb, MacCallum and Voegtlin show a certain relationship between various muscular twitchings and calcium metabolism, also the function of the parathyroid glands. (The subject of calcium metabolism was discussed fully in the chapter on Myoclonia.) A trial of calcium salts and of parathyroids in chorea is therefore indicated. Haneborg, believing that thymus deficiency or perverted function of the thymus is the cause of chorea, advises the use of thymus gland. He reports satisfactory results in pregnancy chorea.

Marinesco advises the use of intraspinal injections of magnesium sulphate (25 per cent). He withdraws first a certain amount of cerebrospinal fluid and injects the same amount of the drug. The amount injected is 1 c.c. to each 25 pounds of bodily weight. Marinesco obtained very satisfactory results in every one of his cases. The slight motor, sensory, and sphincter disturbances which he observed were transitory and all disappeared on the day following the injection.[2] Investigations showed that these accidents were due to the impurity of the salt. He advises against the use of this drug in grave cases, in chorea of pregnancy and in cases of chorea dependent on an organic disease of the central nervous system. Recently Paulian and Dragesco reported 5 cases of acute chorea treated by this method, when arsenic could not be tolerated by the patients. They injected only one to two c.c. of the standard solution (Marinesco) in each case. In all four cases the recovery was complete. The injections were administered every three or four days. Calcaterra employed magnesium chlorid in chorea intravenously with apparently good results. K. Schroeder used the same drug subcutaneously with success. Nine cases of chorea minor in children and 2 cases in adults, rebellious to all other measures tried, yielded to subcutaneous injections of a 20 per cent solution (by volume) of magnesium in small, slowly increased doses,

[2] I have seen very serious paraplegic phenomena follow the intraspinous injection of magnesium sulphate. The treatment is of dubious propriety.—Editor.

from 0.2 to 3 gm. a day, or in very severe cases up to 8 gm. a day. The improvement under the dosage given and the return of symptoms when the drug was tentatively suspended confirmed its therapeutic possibilities. In Schroeder's cases the chorea was of two or three months' standing in most of the patients.

R. Cavalieri reports gratifying results from subcutaneous and intramuscular injections of 25 per cent solution of magnesium sulphate in a case of extremely severe chorea in a boy of thirteen. The first symptoms were noted twelve days before. The solution was made with 4 gm. of magnesium sulphate in 16 gm. distilled water; the dose of 2 c.c. was injected two or three times in the course of twenty-four hours.

The total amount of the drug thus given daily was 1 gm. in this case, and the child was able to sleep at night. The excitement and restlessness had prevented sleep before, and the boy had had to be tied to prevent serious injury from his spasmodic jerkings. By the end of the month he was able to feed himself and was quite restored in six weeks, although left with a mitral insufficiency. The magnesium injections were kept up for twelve days. There was no local necrosis, no pain. It seems, therefore, that subcutaneous injections of magnesium sulphate have the best sedative action. The author advises this method in grave cases of chorea in which the motor agitation is intense, the sleep suppressed and alimentation impossible.

Of late there has been a tendency to connect chorea with syphilis from an etiological standpoint. At first the idea occurred to give arsenic intravenously, since Fowler's solution by mouth has been considered desirable in chorea. With the advent of arsphenamin Bokai was first to administer this drug and he reported satisfactory results. On those premises it was suggested that chorea may be the consequence of lues. Flatau Germanus was the first to express this view and to treat successfully cases of chorea with antisyphilitic remedies.

Milian pleaded very strongly in favor of the syphilitic nature of chorea. He reported 15 cases with positive syphilis in 11 (73 per cent). From this and subsequent studies he arrived at the conclusion that the chorea of Sydenham may have an acquired or hereditary etiology. Babonneix believes that chorea is frequently luetic in origin. An array of writers have subsequently reported very satisfactory results from the treatment of chorea with arsphenamine. However, H. Koplik in an elaborate study does not find striking improvement from the use of arsphenamine and does not feel encouraged in continuing its use.

In 1916 A. L. Goodman advanced a new method of treatment of chorea called "autoserotherapy." It is as follows: The patient is kept in bed for three or four days without medication. About 50 c.c. of blood is withdrawn from a vein and rapidly centrifugalized. The serum is then separated and placed on ice. A lumbar puncture is performed and 20

c.c. of spinal fluid is collected. The serum heated to body temperature is then very slowly injected into the spinal canal. The injection should take from ten to fifteen minutes, and from 15 to 18 c.c. of the serum is used. The patient remains in a recumbent position for one hour after the injection. The author obtained satisfactory results within two or three days after an injection. Usually, he says, one injection is sufficient, but sometimes two or three are necessary. He had 2 cases with a relapse within a year. These relapses are very much milder and more amenable to treatment than before the injections. Of 30 cases thus treated Goodman observed no untoward results. F. Passini observed that upon lumbar puncture in acute chorea the fluid is under high pressure. The removal of from 30 to 40 c.c. in 3 out of 5 cases gave prompt and permanent relief in chorea. In cases of a year or longer standing the nervous system involved suffers beyond possible recuperation from overpressure or from toxic elements in the cerebrospinal fluid. He therefore recommends lumbar puncture before irreparable lesions are installed, as it seems to him to have a direct curative action.

Reëducation Method.—Maloney recommends diaphragmatic breathing as an aid in inducing relaxation of the muscles. The patient is asked to take a deep breath, using his diaphragm, restricting his thoracic movements, and, at the height of inspiration, to pause, then slowly and evenly expire, and again pause after ten or twelve deep respirations. The depth of inspiration and the pause are shortened until the patient is breathing, without effort, as in sleep.

To relax the muscles passive movements are employed. The muscles of the forehead, cheek and jaw are thus manipulated until wrinkling of the forehead and blinking of the eyelids disappear and the muscular spasm is eliminated. Next a shoulder is relaxed, then an arm. The muscles must be passively moved until the parts involved become flaccid. The leg is moved next. During these manipulations the patient's attention should be directed to the possibility of muscular control, so that in a short while complete relaxation is obtained.

The next step is active movements. At first the patient is told to perform rhythmical (with the use of a metronome) movements: flexion, extension, adduction, and abduction. Next in order are the resistive movements in order to maintain tonic contraction of the muscles. When this is done, the patient is reëducated in maintaining a normal attitude: creeping on the hands and knees and balancing on the knees are taught first, then maintaining an erect attitude and progression follow. In all these exercises the patient must avoid fatigue. The latter can be avoided when rest is given after each set of exercises. Precision of movement is another requisite for ultimate success.

Choreiform movements in general (not symptomatic of an organic or of a toxic condition) must not be viewed exclusively from a purely

physiological standpoint. It must be borne in mind that they may be a motor expression of repressed forces in the subconscious realm. In treatment of such cases aid may be obtained from psychanalytic methods. The reader is referred to the chapter on Treatment of Tic.

Chronic Chorea or Hereditary Chorea (*Huntington's Chorea*).—This disease, which has no relation whatsoever to Sydenham's chorea, was known before Huntington, but the latter was the first to call special attention (in 1872) to three important elements of the affection: namely, heredity, onset at the age of thirty or forty, and mental symptoms.

The clinical picture differs little from that of Sydenham's chorea. The movements are arythmical, irregular, incoördinate. Unlike the former the movements are here less abrupt and almost always they may be arrested instantly under the influence of will. The onset is slow but the affection is progressive. The twitchings appear first in the lower half of the face or in the upper extremities, and gradually spread over the entire body. When the muscles of the palate and pharynx become involved, deglutition is difficult. The tongue is particularly affected, so that the speech becomes indistinct and nasal in tone. When the diaphragm is involved, the respiration is disturbed. The grimaces of the face, propulsive movements of the tongue, difficulty of speech, gesticulation of the upper extremities, awkwardness of the hands, projection of the shoulders, difficulty of writing, torsion of the feet, the crossing of the legs which render the gait somewhat jumping—like that of an inebriate—all these manifestations render the disease quite characteristic.

The diagnostic features of Huntington's chorea are: (1) It occurs in adult life. (2) The movements are slower and not as frequent as in Sydenham's chorea. (3) The muscles of the eye globes are usually not involved. (4) The upper part of the face is rarely affected. (5) The gait is analogous to that of an inebriate: the patient makes a few rapid steps, then stops suddenly; leans forward, looks at the ground and then again advances with small steps. (6) Voluntary effort may repress the twitchings. (7) Rest decreases the intensity of the twitchings. (8) As the disease advances the mentality suffers. Extraordinary irritability is constant and is frequently one of the earliest symptoms. Defective power of attention in execution of physical and mental acts is one of the most essential characteristics. Gradually the memory for recent and old events weakens and the conceptions become retarded. The patient is depressed and the intellectual faculties become feeble. There is a tendency to suicide. Dementia is the ultimate result.

The disease is progressive. Death occurs either from disturbance of deglutition and respiration or from some intercurrent disease.

Postmortem findings show an anatomical basis for the disease. Atrophy of the cortex, and especially of the motor area, thickening and adhesions of the meninges, diffuse meningo-encephalitis have been found.

Microscopically disseminated foci of round cells in the pyramidal cells of the cortex and in white matter are quite constant. There is a possibility of hereditary malformation of the central nervous system.

P. Marie, in a recent contribution, expresses the view that Huntington's chorea is both a constitutional and hereditary disease. We are dealing here with a defective congenital resistance of the brain in which a degenerative process of the corticostriate regions is stimulated by an exogenous or endogenous intoxication.

Treatment.—The above-described anatomical basis of chronic chorea gives no encouragement with regard to the treatment. When treated early the patients may derive some general benefit from good hygienic and dietectic measures, from bromids, chloral, hyoscin, antipyrin and arsenic. As a rule, all these means are only palliative and symptomatic. The disease is progressive and incurable.

The degenerative and hereditary character of the affection suggests the possibility of a luetic basis. A trial of neo-arsphenamin combined with mercurials is strongly recommended. Medical gymnastics and systematic exercises may be beneficial for the motor phenomena.

Choreiform Movements in the Course of Chronic Diseases.—The best known among the symptomatic choreas is the posthemiplegic hemichorea which is met with in slight unilateral paralysis and which forms a part of a thalamic syndrome. Hemichorea may be also observed in brain tumors, in paresis, in localized meningitis and in lesions of the superior cerebellar peduncles.

The treatment is that of the original affection.

ATHETOSIS

Athetosis is characterized by continuous, slow, irregular involuntary movements, mostly of the fingers and toes. Rest diminishes the intensity of the movements; they usually disappear in sleep. Will power may decrease them, but emotions exaggerate them. In some cases they are so intense that they simulate chorea (choreo-athetosic movements).

The onset is insidious or rapid. The course is progressive in the majority of cases, affecting the face, extremities and trunk in successive order. When on the face, expressions of fright, joy, laughing or crying, of contemplation, etc., will be alternately observed. The eye globes and tongue usually participate. When the fingers are affected, there will be a continuous display of flexion and extension, abduction, and adduction. When the neck is affected, there will be an oscillation of the head in all directions.

Athetosis may be met with in several conditions, namely, hemiplegia,

hemi-anesthesia, and Little's disease. It is particularly frequent in infantile hemiplegia in which it may be the predominating symptom. It is known under the name of double congenital athetosis.

Double Congenital Athetosis.—It is characterized by athetosic movements of both sides and is accompanied by a spastic condition. Double athetosis is usually associated with mental debility. It is usually a congenital affection. The child develops slowly, cannot speak, walks late; muscular rigidity and athetosis are present.

Three special symptoms characterize this affection: athetosis, muscular rigidity and disturbance of intellect.

The first consists of the movements described above. Muscular rigidity is but slightly marked when the patient is at rest, it is pronounced upon motion so that the muscles may become contractured and deformities of the limbs will be in evidence. In such cases voluntary movements may be difficult, or impossible. The gait is spastic, the patient walks on the toes, the thighs and knees are adducted, the arms are held close to the

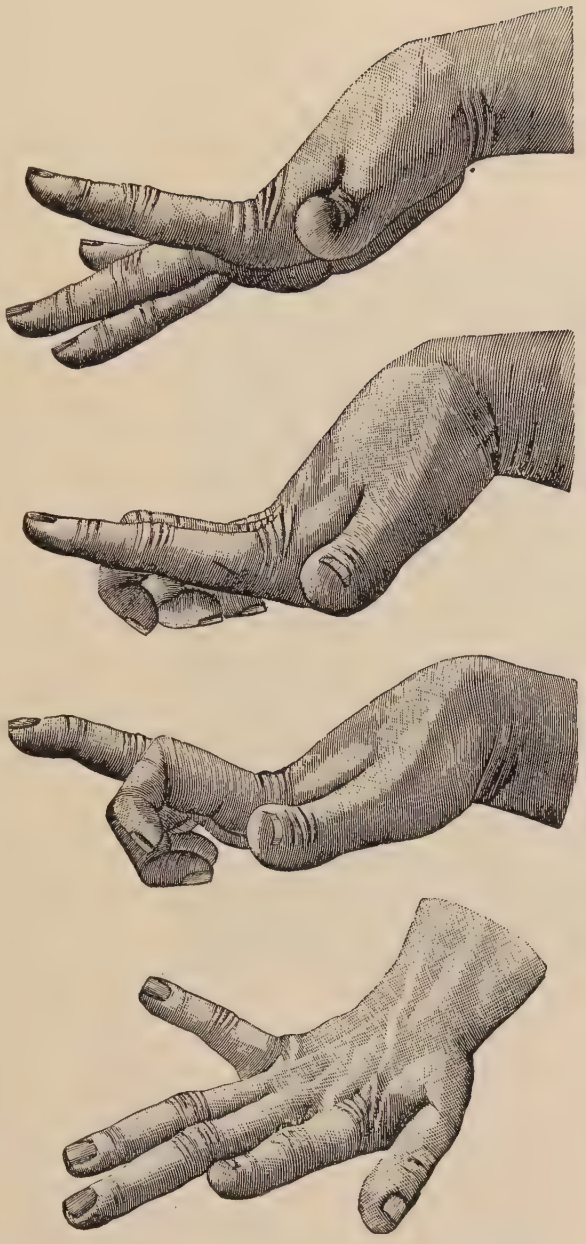

Fig. 10.—Position of Fingers in Athetosis. (Strumpell.)

trunk, the forearms are flexed and the fingers are animated with athetosis. Speech is disturbed: the patient accentuates each syllable, speaks slowly, and often the first syllable is explosive. Writing is almost impossible. Muscular hypertrophy is frequently present because of the excessive exercise. Continuous movements lead to a relaxation of the ligaments and to subluxation of the phalanges, also to scoliosis, kyphosis or lordosis.

Fig. 11.—Dysbasia Lordotica Progressiva or Dystonia Musculorum Deformans. (Oppenheim.)

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The intellect, especially in double athetosis of congenital origin, is usually much below normal and only in a very small percentage is it preserved. Convulsive seizures are observed in some cases. General sensations are usually intact.

The disease develops insidiously but it remains stationary for many years. Death usually occurs from some intercurrent disease.

As to the pathogenesis of double athetosis, the few autopsies recorded are contradictory. Cortical lesions, malformations of convolutions, pachymeningitis, asymmetry of the hemisphere, of the cerebellum, of the medulla and cerebral sclerosis have all been observed.

The researches of C. Vogt, Oppenheim, and the more recent investigations concerning the extrapyramidal lesions in connection with hyperkinetic phenomena, point in the direction of the corpus striatum or of the striatum system as being the site of the pathological cause of athetosis.

Posthemiplegic Hemi-athetosis.—It is observed especially in children, more rarely in adults. In all such cases the athetosis may be the predominant manifestation and the motor or sensory disturbances of the hemiplegia may be very slight. It seems that in all such cases the lesion is an irritative one and is confined to the motor area (in the cortex or in the pyramidal tract). Déjerine is of the opinion that athetosis is due to a lesion of the superior cerebellar peduncle at its termination in the optic thalamus or in the thalamocortical neuron connected with it.

Treatment.—Since in the majority of cases a neuropathic taint is

present, special attention must be given to hygienic and dietetic rules. Syphilis, alcoholism, epilepsy, insanity and other nervous disorders are not infrequently traced in the family; each of these factors must be treated accordingly. Premature or difficult labor, infectious disease and traumata are sometimes the cause of cerebral disturbances followed by athetosis and therefore should be considered as to expectations of results from treatment. Horsley reported satisfactory results from excision of brain centers corresponding to the seat of the disorder. Hammond speaks favorably of nerve-stretching in the localities affected by athetosic movements. Intraneural injections of alcohol have been advised for relaxation of the spastic muscles. In several cases of posthemiplegic athetosis in adults I have obtained diminution of rigidity and of movements from intramuscular injections of 5 minims of 80 per cent alcohol repeated every ten to fifteen days; the injections were made in the thickest portions of the muscles. Some writers advise Foerster's operation, namely, intradural division of several posterior nerve roots. Finally, some claim to have obtained favorable results from fixation appliances or from plaster-of-Paris splints. When a definite diagnosis of a definite lesion is made in cases in which there are evidences of excessive intracranial pressure or of jacksonian epilepsy in addition to athetosis, the question of operative procedures must be seriously considered. Simple but large cerebral decompression (Sharpe and Farrell) and also puncture of the corpus callosum (Anton and Braman) have been advised.

Fig. 12.—Dysbasia Lordotica Progressiva or Dystonia Musculorum Deformans. (Oppenheim).

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Systematic exercises, with the purpose of controlling the movements, kept up for a long time and carried out persistently and patiently, may yield satisfactory results (see description of exercises in Tic). I obtained temporary amelioration from application of Bier's method of passive hyperemia. Sedative medications, such as bromid or chloral, and also hydrotherapy may be tried, but very little can be expected from them.

TIC AND ITS TREATMENT

Tic is characterized by an abrupt involuntary contraction of a muscle or groups of muscles. The contraction has a convulsive character and it may be clonic or tonic. In the first case the individual contractions are separated by intervals of rest. In the second case the contractions are so near each other that they give the impression of a prolonged contracture.

Unlike chorea, tic is characterized by coördinate and systematized movements. In the beginning they consist of muscular contractions executed for a certain definite purpose, but in an exaggerated manner. For example, tic of the eyelids produces exactly the act of sudden closure done to protect the eye from penetration of a foreign body. Gradually when these movements are frequently repeated they become a matter of habit and necessity. Tic is therefore a *disease of habit* which through its persistency acquires a morbid character.

Tic may affect one muscle, if this muscle by itself has a certain functional purpose. Contrary to what is seen in spasm the invaded area does not correspond to a well-defined anatomic distribution of a nerve or nerves. In the majority of cases several muscles contract simultaneously. Occasionally only a certain portion of a muscle may be affected: it occurs in those muscles various portions of which have different functions (deltoid, trapezius, etc.).

Tic has a tendency to spread and invade other functions so that the twitch of the face may be accompanied by a sudden protrusion of the tongue or by a laryngeal noise, by a scream or by a certain gesture in other parts of the body or else by the enunciation of profane or obscene words (*coprolalia* of Gilles de la Tourette).

Tic usually disappears during sleep. Sensations, reflexes, sphincters and cranial nerves are all intact in tic.

Forms of Tic.—Tic of the shoulders consists of a sudden raising of the shoulder.—Tic of Scapula: Either there is a sudden rotation of the shoulder-blade, or sudden elevation of its inferior angle. There is usually present a scoliosis or a history of trauma. Tic of the lower extremities consists of sudden bending of the knees, kicking, etc. Respiratory tic consists of abrupt inspiratory and expiratory movements, such as snuffing, snoring, etc. Laryngeal tic consists of sudden laryngeal sounds or of shouting certain syllables (verbal tic). It is particularly encountered in "tic convulsif" (Guinon and Guilles de la Tourette). The latter consists of blinking the eyes, pouting the lips, protruding the tongue, grimacing the face, blowing, whistling, which are all done with extreme rapidity. Here the tic is not confined to the face, other parts of the body are usually involved; thus one observes raising the shoulder, propulsion movements,

rubbing the hands, stamping the feet, etc. These movements are abrupt and rapid, but they systematically succeed each other.

Voluntary acts arrest the twitchings. They disappear during sleep.

In tic convulsif there may be *coprolalia* (sudden use of obscene words) or *echolalia* (repetition of sounds, syllables), or *echokinesis* (repetition of movements seen). The patient is fully conscious of the condition but cannot overcome the irresistible impulse.

Tic of salaam (spasmus nutans) consists of flexion of the head repeated a great many times—from twenty to fifty a minute. It is a "head nodding."

Tic in general is amenable to treatment, but the tic convulsif has a grave prognosis.

Treatment.—In tic besides motor phenomena there are always present psychic disturbances, such as a state of anxiety, depression, phobias, etc. Besides, the fact that a voluntary effort may inhibit or arrest the twitchings points to the presence of mental elements in the affection. An hereditary predisposition to functional nervous disorders is very frequently present. For all these reasons, special attention should be given to the general health and to psychic methods. Proper hygienic and dietetic measures, a life free from excitement and emotions are indicated. Isolation and rest in bed are beneficial. Training the will power in overcoming the involuntary movements by pointing out to the patient the local physical cause which originated the tic is essential.

Pressure upon certain points in distribution of the fifth nerve often arrests the tic of the face, particularly at the supera-orbital foramen. The same can be applied to tic of any part of the body. Thus the tic may be reflexly inhibited and by constant repetition the habit spasm (tic) may be broken. Favorable results may sometimes be obtained from very strong faradic currents applied to the muscles involved. Massage may sometimes be of benefit.

Brissaud, Meige, Feindel, and others obtained satisfactory results from special physical and psychic methods. The first consists of *voluntary immobilization* followed by systematic exercises. When immobilization is employed, the patient is taught to immobilize the affected muscles for a gradually increasing period of time. The sittings are held daily, at first only for a few seconds and only two or three times a day. Gradually the number of exercises is increased and the duration of each is prolonged.

A child must be placed in charge of a trained person. An adult can be taught how to proceed. He is advised to have before him a mirror so that he can watch the procedures. When a certain amount of control has been obtained by the patient, the next method is taken up, namely, *voluntary movements.* In the latter the muscles are made to contract in a slow, deliberate and correct manner, so that eventually they fall under control and thus become trained. In this phase likewise the first attempts

must be of brief duration. Gradually the time is increased. With patience and persistence the patient acquires skill in the treatment.

As to medication, sedatives are indicated, but cannot be relied upon for total removal of the disorder.

Modern investigations have shown that the functioning of nerves and muscles is dependent on the normal course of calcium metabolism. Loew has apparently established that the normal functioning of the cell is controlled by the calcium content of its nucleus, and others have shown that administration of calcium salts reduces to normal the exaggerated excitability of certain nerves. These and other data justify systematic calcium treatment of spasmodic twitching of all kinds, especially since it is known that no gross anatomic basis has been discovered for tic convulsif, for example. The success from systematic administration of calcium chlorid in two severe and chronic cases of tic convulsif reported by Emmerich and Loew apparently confirms this view. The first patient was a locksmith of forty-nine, who for twenty years had suffered from chronic ticlike spasms of the muscles in the neck and right arm, and they had gradually increased in intensity during the last ten years until there were forty-five a minute and the muscles had become enlarged, while the man was becoming so exhausted that a fatal outcome was imminent. At each attack the head was twisted around. Except for potatoes, he seldom or never took vegetables, fruit or milk, although his diet was plentiful, mostly eggs, meat, and bread. The calcium content of this diet averaged only 0.721 gm. while the magnesia content was 1.113 gm. A solution of 100 parts pure crystallic calcium chlorid in 500 parts of distilled water was ordered, a teaspoonful three times a day. At the fourth month there were only eight attacks a minute and by the eighth month the tic was entirely cured and the strength regained. Equally good results were realized from the same treatment in a case of ticlike rotation of the head from a spasm of the splenius capitis. By the fifth month the patient, a letter carrier, was entirely free from his "rotatory tic."

In discussing the pathogenesis of tic, mention was made of the neuropathic make-up of those who acquire tic through habits. With our present knowledge of human behavior, especially with regard to the relation of repressed instinctive and emotional factors to the organized forces or trends that are grouped together under the conception of the subconscious, single abnormal phenomena in the life of an individual may be considered as an adaptive mechanism by means of which repressed forces express themselves in a disguise. In neuropathic individuals there is a special organization of the instinctive and affective life, and there is a special tendency to motor discharges of abnormal character. Psychanalysis has for its object to reveal the instinctive and emotional patterns of individual reaction. In treatment of cases of tic one must not only deal with the symptoms in merely physiological terms but also one

must endeavor to determine to what extent the complex factors of the subconscious and the conscious life are involved in the development of the abnormal symptoms.

TETANY AND ITS TREATMENT

Tetany is characterized by bilateral, intermittent, painful cramps in the muscles of the extremities, especially in the hands. They may spread to the trunk. The spasms occur in paroxysms. They are usually preceded by a few premonitory symptoms, namely, paresthesia (tingling, numbness, etc.), general malaise and sometimes by mental depression and vertigo or headache. In the majority of cases cramps appear first in the fingers. The attitude of the hand is very characteristic: it is either in a writing position or in an obstetrical position, namely, the fingers are extended, the first phalanges are flexed, the thumb is against the palmar surface of the fingers, the entire hand is flexed. Variations in this attitude are observed. When the interossei and lumbricales are affected, the hand is in a clawlike position. When the contracture spreads and involves the arm, the latter is in a forced flexion and applied to the thorax. In the lower extremities the flexors of the foot and toes are found mostly in a state of tonic contraction. The toes are flexed and adducted, the feet are arched and in the attitude of equinovarus, the calf muscles are hard, the legs and thighs are extended.

FIG. 13.—A CASE OF TETANY DURING AN ATTACK. (Oppenheim.)
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Tetany may also affect the muscles of the trunk, abdomen, and neck, and in rare cases also the ocular muscles. When the neck muscles are

involved, the head is bent forward and the chin touches the chest. The muscles of the face, of the tongue, and the ocular muscles are occasionally affected. The diaphragm and larynx may participate and then the patient is threatened with suffocation. If the sphincter of the bladder is involved, retention of urine will be present.

Tetanic contractions are usually very painful and the least attempt to move the affected parts increases the pain. During a paroxysm the temperature is slightly elevated and the pulse is accelerated. The spasm may persist during sleep.

In addition to the above clinical picture the following symptoms are observed between the paroxysms:

1. **Trousseau's Sign.**—Compression of the biceps or immediately below the inferior insertion of the deltoid in the upper extremities and compression of the internal surface of the thigh in the lower extremities will produce a contraction of the corresponding muscles. Franklin-Hochwart has shown experimentally that compression of the nerve trunks is the cause of the contracture.

2. **Chvostek's or Facial Sign.**—Percussion or any mechanical irritation of a motor or mixed nerve or of the muscles of the face in the middle of a line passing from the external ear to the labial commissure produces a very vivid muscular contraction.

3. **Weiss' Sign.**—Percussion of the temporofacial branch at the external angle of the orbit produces a contraction of the muscles of the orbit.

4. **Hoffmann's Sign.**—Pressure upon sensory nerves produces marked pain or paresthesias. Their electrical excitability is also increased.

5. **Erb's Sign.**—The electrical excitability of motor nerves is increased so that a very mild galvanic or faradic current gives a prompt and marked muscular contraction. The contraction is prolonged. The anodal closure or opening contracture is more prompt than the cathodal contraction. Increased response to galvanism is more frequently observed than to faradism. Among all the nerves the ulnar is the most responsive.

6. **Schlesinger's Sign.**—If the extended lower limb is forcibly flexed over the pelvis, a spasm will appear in the extensors of the knee, and the foot is placed in the position of extreme supination.

Among other symptoms may be mentioned vasomotor and trophic disturbances, such as herpes, edema, etc. During an attack the face is flushed, the extremities are cyanosed. The reflexes and objective sensibility are usually intact.

In children Escherich described a *permanent* and an *intermittent form of tetany.* The former may simulate tetanus or cerebrospinal meningitis. The latter form is met with in cases of rachitis and craniotabes. Here the paroxysms occur at long intervals, and are of very short duration. They

are confined to the extremities, but a very frequent occurrence is "laryngospasm" which is tetany of the respiratory muscles. It occurs under the influence of the least emotion and, if it increases in intensity and frequency, it may terminate in asphyxia. Indicanuria is frequent in children.

Attacks of tetany may vary in frequency. The prognosis is favorable but recurrences are not infrequent. Cases with gastric dilatation or with exophthalmic goiter present an unfavorable outlook.

The occurrence of tetany in connection with gastro-intestinal disorders, with removal of the thyroid or parathyroid glands and with infectious diseases speaks in favor of a toxic or infectious origin. Experimental researches and close observation are strongly in favor of parathyroid insufficiency being the pathogenetic factor in tetany. Gley and others have shown that removal of parathyroids produces in animals and man grave tetanic manifesations which may become fatal.

Infantile tetany, Escherich believes, is due to a general dyscrasia resulting from metabolic disturbances produced by unfavorable hygienic conditions. This dyscrasia explains the associated morbid manifestations, namely, rickets and a lymphatic state; its influence on the nervous system of these impressionable children produces an exaggerated excitability, namely, tetany.

In *gastric tetany* an ulcer of the stomach with resulting pyloric stenosis and gastric dilatation has been found. There is usually hyperchlorhydria. Here a toxic element from the stomach is probably added to the already existing parathyroid insufficiency. Langmead has called attention to tetany in association with dilatation of the colon. The spasms occur regularly and appear to be in intimate relation with the character of the feces.

Treatment

The treatment of tetany is directly dependent upon the pathogenetic factors of the disease. First of all, the former researches of Loeb and J. B. MacCallum have shown that there is a great relationship between tetany and reduction of calcium salts in the organism. An analysis of blood taken from a dog during tetany shows an amount of calicum which is only about half that of a normal dog on the same constant diet. It is also known that the parathyroids control the calcium metabolism so that upon their removal a rapid excretion deprives the tissues of calcium salts. More recently MacCallum, Lambert and Vogel experimented with dialyzed blood from which a large part of its calcium was removed. When this blood was perfused through an isolated extremity, extreme-hyperexcitability was produced. On the other hand, perfusion of dialyzed blood containing calcium in the same proportion as normal blood causes no hyperexcitability. Evidently hyperexcitability is due to the lack of

calcium. Parathyroidectomized animals were bled and the blood was replaced in one case with normal blood, in the other with dialyzed blood poor in calcium. The normal blood immediately relieved the hyperexcitability and tetany caused by the removal of the parathyroids, while the dialyzed blood did not. Cruickshank calls attention to the following facts: the calcium content of 100 c.c. of normal blood amounts to the following figures: total 9.12 mg., plasma 8.11 mg., and cells 1.01 mg. In tetany: whole blood 5.7 mg., plasma 5.26 mg., and cells 0.46 mg. These figures show a loss of calcium amounting to 37.2 per cent for the whole blood, to 54.4 per cent for cells, and to 35.2 per cent for plasma. Diffusible calcium in normal serum averages from 60 to 70 per cent, while in severe parathyroid tetany it amounts to 94 per cent of total calcium. The immediate relief of the condition consequent on the withdrawal of from 70 to 100 c.c. of blood is indicative of a toxic causative factor. The calcium deficiency and the loss of collodial calcium are merely indicative of a rapid protein disintegration.

The value of calcium metabolism is therefore established. For these reasons administration of calcium salts or of parathyroids is indicated in tetany. The intravenous method is the best for calcium salts. From 40 to 80 gr. calcium lactate are diluted in from 400 to 500 c.c. of normal salt solution. The injection can be repeated in twenty-four hours if necessary.

Schloss prescribes 1 gm. tricalcium phosphate in 10 gm. cod-liver oil, in doses of 5 gm. twice daily. He prefers calcium phosphate to calcium chlorid because the latter has a bad effect on children.

As to parathyroids, the latter may be administered by mouth, intravenously or by grafting. The intravenous method gives the best results. Krabbel has reported excellent results from implanting parathyroid bodies in the tibia of one patient and in the preperitoneal space of another patient.

In spite of these apparently evident proofs concerning the value of the parathyroids, the claim as to their relation to tetany commences to be questioned. Paton, Findlay, and Watson believes that the most constant change after parathyroidectomy is the increase in the response to galvanic stimulation, but there is no direct relationship between the severity of the nervous symptoms and the electrical excitability of the peripheral neuromuscular mechanism. Further investigations of the same authors tend to deny the controlling influence of the parathyroids over the central nervous system, also the rôle of loss of calcium as postulated above. The same authors observed that the phenomena of guanidin poisoning correspond very closely with those of tetania thyreopriva. They found a marked increase in guanidin and methylguanidin in the blood and urine of animals after removal of the parathyroids and also in the urine of children suffering from idiopathic tetany.

Nervous manifestations resembling those of parathyroid tetany have been observed in animals following various experimental procedures and in man in various pathological conditions. Thus L. R. Dragstedt noted tetany in dogs following the production of an acute obstruction in the duodenum, an occlusion of the pylorus. The feeding of excessive quantities of meat to dogs having Eck's fistula causes tetany. In man the latter is seen in gastro-intestinal disorders, in acute dilatation of the stomach and duodenum, dilatation of the colon in children and in various forms of intestinal toxemia. The same author states that the feeding of meat to parathyroidectomized dogs accelerates the onset and increases the severity of tetany. The theory of intoxication therefore forces itself, especially in view of the discovery of various toxic bases(guanidin, cholin, etc.) in the urine and blood of parathyroidectomized animals. Dragstedt, like Paton and his collaborators, is strongly in favor of toxic substances chiefly from the gastro-intestinal tract being responsible for tetany. The function of the parathyroid glands according to Dragstedt is to prevent intoxication by these toxins. Notwithstanding the latter researches, those of MacCallum and of his collaborators mentioned above stand out unmistakably, and the calcium problem is accepted by the majority of observers. The administration of calcium salts is strongly advisable. In view of the importance of the parathyroids great care must be taken in preserving these glands in cases of operative procedures on the thyroid gland. Internal administration of parathyroid extract is indicated.

For the pathogenetic reasons mentioned above, gastro-intestinal disorders should be remedied by intestinal antiseptics, enemas and emetics if necessary, but the stomach-pump must be avoided (see above). The spasm itself can be relieved by sedative medication, such as bromids, morphin, chloral. Subcutaneous injections of sterilized physiologic salt solution or rectal injections of milk and water may be of some assistance.

Among other drugs, ammonium chlorid, especially in infantile tetany, has been praised by Freudenberg and György. With from 3 to 7 gm. per day they were able to check the mechanical and faradic hyperexcitability and rid the patients of the manifest symptoms of tetany. Sometimes the medication has to be kept up for several days. It averts the acute danger, and time is gained in which to bring about a permanent change in the condition by means of cod-liver oil. Ammonium chlorid is preferable to calcium chlorid for the reason that it is pleasanter to take. The writers, however, state that the effect of the drug is only symptomatic.

Rest in bed is an excellent measure in some cases. Trousseau advises application of ice to the spine. On the other hand, tepid baths administered several times a day for from ten to fifteen minutes may be of great benefit. Galvanism may sometimes render good service. In one of my cases absolute rest with exclusive milk diet without medication gave very satisfactory results. In gastric tetany which is rebellious to treatment,

gastro-enterostomy should be undertaken since excellent results have been reported. In cases of asphyxia due to spasm of the glottis hypodermic injections of pilocarpin or application of a wet cloth to the neck may be useful. Digitalis is advised by Gowers.

TREMOR AND ITS TREATMENT

Tremor is characterized by involuntary rhythmic oscillations of the body or of portions of it. It is a symptom of a great variety of conditions. In some cases it is of such great importance that it is pathognomonic of the disease. The seat and character of tremor is very variable. It may be passive, namely, when the body is at rest; intentional, namely, upon voluntary movements; coarse or fine; of wide or small amplitude; it may be vertical or horizontal. It may be physiological or pathological.

Physiological Tremor.—It is the expression of a sudden and transient disturbance in the neuromuscular apparatus. It occurs after violent exercises or after excessive fatigue. It may follow a sudden emotion or an exposure to cold; in such cases the entire body is affected. Emotional tremor is accompanied by vasomotor disturbances. Fever is also accompanied by chills and tremor.

Tremor of Neuropathic Individuals.—It is met with in persons with a neuropathic heredity. Sometimes several members of the family of an entire generation are affected with a more or less pronounced tremor. It may appear in infancy or in adult life; at first it is slight and later, as the individual grows older, it becomes more pronounced. The muscles of the neck are most frequently affected; the upper extremities are next in order; the lower extremities are very rarely invaded.

The rhythm of this tremor is variable: from 4 to 8 or 9 oscillations per second. In senility it is slow, but in childhood rapid. It becomes accentuated upon fatigue or upon the least effort. It lasts indefinitely.

Tremor of Neuroses.—Here the tremor is but one of a multiplicity of symptoms. In neurasthenia the upper extremities are most frequently involved; it is particularly noticeable after an emotion; it disappears when the individual rests. The individual oscillations of the tremor are brief and of small amplitude. In hysteria the tremor is polymorphous, namely, it may simulate all sorts of tremors. It is one of the stigmata of the disease. It sets in usually suddenly after an emotion; it may be *vibratory* in character and as such it occurs mostly after a hysterical paroxysm. It is present even when the body is at rest, but disappears in sleep. Hysterical tremor may simulate that of multiple sclerosis or mercurial tremor, or else that of paralysis agitans. In epilepsy the muscular exhaustion following a convulsive seizure is frequently accompanied

by a tremor. The latter may be, besides the unconsciousness, the sole symptom of an epileptic attack.

Tremor of Graves' Disease.—Tremor is a constant symptom of Graves' disease. Sometimes the entire body oscillates, but the extremities are particularly involved. There is a trepidation in the lower limbs. The oscillations are brief but rapid (8 or 9 per second). The tremor persists even at rest.

Tremor of Paralysis Agitans.—Tremor is the most conspicuous of all the symptoms of paralysis agitans. The amplitude of the oscillations is small; the movements are regular and of slow rhythm (4 to 6 per second). It is particularly marked at rest. Passive and voluntary movements interrupt the tremor for a little while. On the other hand, fatigue and emotion exaggerate it. The upper extremities are most frequently involved, and the thumb and index finger are first affected. The position of the hand is characteristic: the fingers are extended and in adduction, the first phalanges are in semiflexion. The oscillatory movements of the thumb and index resemble the act of rolling pills or crumbling bread. In the lower limbs there are rapid and alternating flexion and extension of the foot and striking the heel against the floor. In the face the lips and tongue are affected with a rapid tremor. Tremor may be confined only to one side of the body.

Tremor of Organic Diseases of the Nervous System.—In hemiplegia irregular oscillations resembling chorea are observed before or after the apoplectic insult. In tumors of the cerebral peduncle, tremor has been observed resembling that of paralysis agitans. In Weber's syndrome (paralysis of one third nerve and hemiplegia on the opposite side) tremor may be present in the paralyzed limbs.

In multiple sclerosis one of the classical symptoms is intention tremor which disappears when the patient is in bed, but which is increased upon emotion and keeps on increasing when a voluntary act is prolonged. In the latter case the patient has difficulty in feeding himself, in dressing, etc. The tremor is generalized but especially pronounced in the upper extremities.

In Friedreich's ataxia voluntary movements are accompanied by a special tremor; the hand hesitates in grasping an object; after some turns above it, it finally falls suddenly down on the object and seizes it in an exaggerated manner.

In cerebellar diseases a tremor is sometimes observed. It is slow, of wide oscillations, and occurs only upon voluntary movements.

In paresis there is a rapid and generalized tremor affecting the tongue, lips, zygomatic muscles and hands. It is particularly marked in attempts to perform fine and delicate acts.

Tremor in Intoxications.—In alcoholism tremor is but slightly marked at rest. The hands are particularly affected; the tongue and the

muscles of the face show very fine oscillations. The tremor is pronounced in the morning before food has been taken.

It is fine (6 to 7 oscillations per second). When delirium occurs, the tremor is very intense.

In mercurialism the tremor is of an average rhythm. It persists at rest and becomes more marked upon motion and fatigue. It commences usually in the muscles of the face, lips, tongue, and descends to the upper and then the lower extremities. The tremor is polymorphous.

Tremor may also occur in intoxication with morphin, opium, heroin, hashish, lead, tobacco, caffein, arsenic, belladonna, ergot, and curare.

Treatment.—Tremor, being only a symptom, will be treated in conjunction with the other manifestations of the original malady. The reader is referred to the respective chapters. In Graves' disease, for example, the pathogenesis with regard to hyperthyroidism or to the function of the sympathetic system must be borne in mind. In paralysis agitans the function of the parathyroid should be thought of.

Calcium metabolism was discussed with regard to the origin of the hyperkinetic diseases (chorea, tetany, etc.). The reader is referred to those chapters for the data presented from various sources justifying the metabolic conception concerning the calcium problem. Various preparations of calcium with or without combination of other drugs were mentioned on those pages.

Sedatives of all varieties, bromids, chloral and hyoscin, may be employed. Hydrotherapy, mild régime, a quiet life free from emotion and excitement and avoidance of stimulants are all of benefit.

Finally, tremors of all varieties may be relieved by the application of Bier's method of induced hyperemia. As was mentioned in the preceding chapters the writer has obtained satisfactory results from such a procedure, when it is systematically applied, in many forms of hyperkinesis.

Tremor occurring as a result of a psychic force, such as we observe in hysteria, etc., must be viewed not only from a purely physiological standpoint but also as having a psychogenetic origin. The reader is referred to the section on the Treatment of Tic.

PARALYSIS AGITANS (PARKINSON'S DISEASE, SHAKING PALSY)

Tremor, attitude, facies and gait are the elements presenting special features in the disease.

Tremor.—Tremor is present in the majority of cases. It is *passive,* namely, it is present when the body is at rest. It usually disappears at first upon a voluntary movement, but returns if the latter is sustained. The tremor affects most frequently the hands and fingers but it may in-

volve other portions of the body. Sometimes all the fingers are agitated, but the thumb is especially affected. It moves to and fro over the palmar surface of the other fingers and in a continuous manner; its oscillations remind one of the act of rolling pills or of crumbling bread. The tremor is rhythmical. It decreases from the distal end toward the root of the limb so that it is not perceptible at the shoulder.

When the tremor is in the lower extremities and the patient is seated, the toes are held against the floor, but the heel keeps on striking the floor in a continuous and rhythmical manner. The tremor of the head is usually transmitted by the arms. The tremor of the lips gives the impression of muttering silently. The tremor disappears during sleep. Emotions and strong exertion increase it.

FIG. 14.—PARALYSIS AGITANS. Note facies and attitude.

Attitude.—The head is inclined forward, the back is curved. The patient holds himself rigid; he turns, walks, sits down, and gets off his chair as one rigid mass. There is a generalized muscular rigidity. The movements of the body are slow and monotonous. The rigid state produces a certain degree of muscular weakness which disables the patient for work or even for ordinary voluntary acts.

Facies.—There is immobility of features. The face is masklike. It gives the impression of astonishment, surprise, fright. It is due to rigidity of the facial and ocular muscles.

Gait.—In the majority of cases the steps are small and gait is slow. In advanced cases the following is observed. When the patient attempts to walk, he inclines the body forward, steps first on his toes and then, for fear of falling, he is obliged to accelerate his gait and run. In some cases there is only an accelerated tendency to fall forward (propulsion). The slightest push will make the patient run until an obstacle is met. The same phenomenon is observed when the patient is pushed backwards (retropulsion) or laterally (lateropulsion).

The *speech* is also altered: monotonous voice and rapidity of speech are its characteristics.

Sensory disturbances are only of a subjective nature. The patients frequently complain of rheumatic pains in the limbs, of muscular fatigue and numbness. Sensations of heat, abundant perspiration and cyanosis of the extremities are the other symptoms.

The tendon reflexes are frequently increased. The plantar reflex is usually of the flexor type.

Some mental depression, apathy and indifference are present in the majority of cases.

Modern researches have shown, especially since the studies of encephalitis lethargica have been pursued from the anatomical standpoint, that muscular rigidity of the parkinsonian type with or without tremor is invariably accompanied by destructive changes in the "locus niger" in the midbrain; its cells are replaced by neuroglia. The globus pallidus, or rather the pallidal system, is also involved, but to a lesser degree. Changes have also been found in the red nucleus, pons, and cerebellum. The cerebral cortex not infrequently shows histological alterations. The consensus of opinion is that the parkinsonian syndrome is the expression of an involvement of a vast system, namely, corticomesocephalic.

G. Maillard considers paralysis agitans as due to arteriosclerotic changes in the red nucleus. Other observers found changes only in the muscles, namely, a nuclear proliferation in the sarcolemma, atrophy of some fibers and diminution of muscle-spindles. In the peripheral nerves increase of interstitial tissue and slight degenerative changes in the fibers have been found in some cases.

Experimental researches have apparently demonstrated that the normal parathyroids are regulators of neuromuscular functioning. Roussy and Alguier found these glands in a pathologic state in several cases of paralysis agitans. Manthos reports a case of typical Parkinson's disease in which the parathyroids were very much enlarged.

Treatment.—Lundberg, Berkeley, and others have observed that the symptoms following parathyroidectomy resemble closely those of paralysis agitans. On the other hand, MacCallum has shown that a suitable dose of a soluble calcium salt injected into the vein of a dog that has been successfully operated upon in this way will in a few hours restore the animal to a normal condition. These experiments, as well as those of other investigators, show that the parathyroid glands preside in some way over the calcium metabolism, and the symptoms under discussion are caused by a deficiency of calcium (see also chapter on Tetany). Administration of parathyroids, or of calcium, or of both has been greatly beneficial (Berkeley, Beebe, etc.). Berkeley obtained especially favorable results from fresh parathyroids, but in view of the high price and the disagreeable taste he used the following preparation of the gland: An acetic extract of the fresh glands is made by treating the ground or triturated glands with cold distilled water, filtering and then precipitating

with a very minute amount of acetic acid. This extract is put up in doses of 1/50 gr. in a capsule or as a hypodermic solution. Fifteen minims of the latter is used for an injection. A prolonged treatment (from three to six months) is necessary. Berkeley claims that 60 per cent or 70 per cent of cases have greatly benefited from this treatment; the progress of the disease has been arrested or very materially retarded.

W. Kühl used parathyroid grafts in a typical case of paralysis agitans. He removed from two anesthetized calves, before they were slaughtered in an aseptic manner, the parathyroid glands, which were placed in a warm physiologic sodium chlorid solution. A quarter of an hour later he transferred them to the patient, embedding them under the abdominal skin at two different points. The result was very surprising. Retropulsion was no longer observed after the eighth day; likewise dragging of the feet in walking had almost disappeared; it was also noticeable that the play of the features was more normal. After the fifteenth day the man could lie down on the ground and rise unassisted whereas before the operation he had always to be lifted out of bed. He could also fold his arms across his chest, could feed himself, and was able to spread out his fingers, whereas he had kept them either closed or stiffly extended. He was now able to write for the first time in three years. Kühl thinks the results prove that muscular rigidity in paralysis agitans depends on a hypofunctioning of the parathyroid glands.

As to the use of calcium, the methods of its administration have been fully described in the chapter on Treatment of Tetany.

Among various drugs used in paralysis agitans the following may be mentioned: hyoscin hydrobromate, cannabis indica, codein, opium, arsenic, bromids, tinctura gelsemii and veratrum viride. The first is the most useful. Given internally in gr. 1/200 doses two, three or more times a day, it sometimes relieves the tremor as well as the rigidity. P. E. Démètre and Brauner employed hyoscin in combination with magnesium sulphate in conditions depending on lesions of the lenticular nucleus, such as athetosis, paralysis agitans and others. In the latter they first injected subcutaneously 0.001 gr. of hyoscin and in one-half hour the tremor disappeared. This is followed by an intraspinal injection of magnesium sulphate (1 to 2 c.c. of a 25 per cent solution). On the third day they used first the magnesium followed by the hyoscin. The tremor was particularly benefited.

The rigidity of paralysis agitans may be greatly relieved by warm baths and gentle massage. The tremor is sometimes ameliorated by trepidation in a carriage or train. Some of my patients obtained great relief by riding on a train two hours a day. Similar benefit has been derived by my patients from a very frequently interrupted faradic current.

Rest, which is so beneficial in neuroses, is contra-indicated here. However, violent exercises or undue fatigue must be avoided.

W. B. Swift has recommended a method of treatment which consists of muscular movements carried out very slowly, at the rate of about 3 feet to the ten seconds, with strong mental concentration upon the movements while in progress. First come movements of the right foot, then of the left, then of the legs successively, then of the right and left arms in order, then of both arms, and finally of the hands and fingers. The execution of the movements should last each time from fifteen to thirty minutes and should be carried out three times a day. All sudden, quick or reflexlike motions should be omitted. The object of the method is not muscular development but rather development of nervous control over the muscles. The essence of the treatment lies in the slowness of the exercises, otherwise failures are bound to follow. The chief purpose of these exercises is to develop a feeling of pervading steadiness to such an extent as to become a constant feature of the patient's daily life. The author's view is to build up a central inhibitory control. The exercises administered by the author are:

1. Right arms up to side. Down (shoulder level).
2. Right arm up front. Down.
3. Right arm up back. Down.
4. Right arm flex. Extend.
5. Right hand open. Shut.

6-10. Same for left arm.

11-15. Same for both arms together.

16. Right leg up front. Down.
17. Right leg up back. Down.
18. Right leg up to side. Down.
19. Right leg flex. Extend.
20. Toes extend. Flex.

21-25. Same for left leg.

CATALEPSY AND ITS TREATMENT

By this term is understood an assumed fixed and persistent attitude in the course of which the individual is unable to contract his muscles voluntarily.

The person thus affected remains in the same position in which he was placed, the eyes are widely open and fixed; the limbs are immobile. The appearance of the cataleptic is that of a mannikin. He may preserve this attitude an indefinite time without experiencing any fatigue. Curiously enough, the muscles are not contracted (flexibilitas cerea). The

patient can be made to walk, but after having made automatically a few steps he promptly resumes his former fixed position.

As to the nature of catalepsy, it is essentially a hysterical phenomenon. A hysterical individual may at any time, especially under the influence of an extreme and sudden emotion, fall into a cataleptic state. The writer has seen cases in which an hysterical paroxysm with convulsive manifestations terminated with a cataleptic attitude.

Treatment.—Since hysteria is a psychic malady, its various phenomena must be treated with psychic procedures, such as suggestion, persuasion, psychanalysis, etc. The reader is referred to the chapter on Hysteria in this book.

CATATONIA AND ITS TREATMENT

Catatonia is characterized by a tendency to assume and to maintain a certain attitude by the patient himself. While in this fixed state the position of any part of the body may be changed by any one into another position. The most awkward attitude will thus be kept up by the patient an indefinite time, hours or days. Unlike catalepsy in catatonia there is a genuine muscular rigidity.

Catatonia is met with in mental affections, such as confusional psychosis, melancholia; also in the course of toxi-infectious conditions, such as typhoid fever, uremia, alcoholism. It may be also encountered in low grades of mental deficiency (idiocy and imbecility). There is one mental affection in which catatonia is the predominating manifestation: this is dementia præcox. The symptom is so pronounced in some cases of the latter that Kahlbaum created under the name of catatonia a special form of dementia præcox. In this variety the catatonic automatism may sometimes be accompanied or substituted by other automatic phenomena, namely, stereotypy, in which the patient repeats the same movement with his hand in action or in writing, or verbigeration, in which he repeats the same syllables or words an indefinite time.

Treatment.—The treatment for catatonia is the same as for dementia præcox in general. In the cases of non-mental origin, in which the catatonic phenomenon is symptomatic (toxi-infections), it will disappear after the original infectious or toxic factors have been removed.

CONTRACTURES AND THEIR TREATMENT

A contracture consists of a persistent and involuntary tonic contraction of a muscle or of a group of muscles. It may be permanent or temporary, generalized or localized. According to the function of the affected muscles, the attitude of the involved limbs will vary; there may be

flexion, semi-flexion, or else extension. According to the intensity of the contracture there will be variation in the rigidity of the muscles.

Contracture is greatly diminished in narcosis or in artificially induced ischemia of long duration. As to the functional disability of the affected muscles, it presents all degrees according to the intensity of the contracture. In some cases involuntary movements are seen in the contractured muscles. Athetosis, choreiform movements, choreo-athetosis in hemiplegia of children and tremors in hemiplegia of adults are not rare. The contractured muscles not infrequently undergo atrophic changes such as we observe in hemiplegia, or else slight hypertrophic changes, which are seen in cases of athetosis. As to the pathogenesis of contractures, they may be either of muscular origin or of nervous origin.

Contractures of Muscular Origin or Pseudocontractures.—They are due primarily to an irritation of the muscular tissue. They are observed in myositis, traumatism, tumors or foreign bodies, gummata, finally in local ischemia. As an example of the latter, intermittent claudication may be mentioned.

Intermittent Claudication.—The disorder is due to a partial obliteration of a large blood-vessel supplying a limb and consists at first of a sensation of heaviness in the limb, which gradually increases in intensity so that the limb becomes rigid and cyanosed and the individual is unable to proceed in using it. After a few minutes of rest, the limb becomes normal again.

The disorder usually occurs in the lower extremities and develops only after attempts to walk. As to the obliteration of the blood-vessel, it usually occurs after infectious processes, in syphilis, gout, alcoholism, saturnism, in arteriosclerosis, in thrombo-angiitis obliterans; also in cases of excessive use of tobacco.

Contractures of Nervous Origin.—Contractures due to an involvement of the pyramidal tracts are the most frequent. The lesion may be in the motor area of the cortex or in its projection fibers. When the lesion sets in suddenly, as in cerebral hemorrhage, the muscular rigidity develops gradually. When, on the contrary, the lesion develops slowly, as in some cases of transverse myelitis, the rigidity appears in the beginning. The contracture may affect one limb, or two symmetrical limbs, or else two limbs on the same side of the body. Diseases of the spinal cord in which the pyramidal tract is involved lead to contractures. One finds the latter in compression, Pott's disease, lateral sclerosis, combined sclerosis, hematomyelia and syringomyelia.

Contractures of Meningeal Origin.—In acute meningitis most frequently the muscles of the neck and of the trunk are involved. The muscular rigidity may be so intense that a backward hyperextension of the head is striking. The presence of rigidity in other muscles of the body can be elicited by the presence of Kernig's and Brudzinski's signs. The

abdominal muscles, the muscles of the face (trismus) and of the neck (torticollis) may also be involved. Not only the acute forms but also the chronic varieties of meningitis as well as meningeal hemorrhages and pachymeningitis may be accompanied by muscular rigidity. The cause of the latter lies probably in an irritation of cerebral centers.

Contractures of a Functional Nature.—For contractures in paralysis agitans as well as for their pathogenesis the reader is referred to the corresponding chapter. Suffice it to mention here that in some cases muscular rigidity per se constitutes the entire clinical picture, and when it is permanent it not only gives the body and the limbs peculiar persistent attitudes, but also interferes with the individual's activity and gait.

In *hysteria* contractures may affect a group of muscles, one muscle, a segment of a limb, a whole limb, etc. They may simulate an organic monoplegia, hemiplegia, paraplegia or diplegia. They usually occur after an emotion, a trauma or following an hysterical paroxysm. The onset is sudden and the contracture reaches its maximum in the beginning. The characteristic feature of an hysterical contracture is that it can be overcome, a condition which cannot be obtained in contractures of organic nature. The common picture is: flexion of the forearm, intense flexion of the fingers, closed fist, flexion of the wrist, extreme extension of the legs and plantar flexion of the toes, equinovarus of the foot. In hysterical coxalgia the limb is in persistent adduction and internal rotation. In arthralgias the limb is usually flexed but it may assume all sorts of positions. Other muscles may be under the influence of hysterical contractures, such as the sternomastoid muscle, individual adductor or abductor muscles, flexors, etc.

Hysterical contractures are very variable: they may last but a few days or may persist for weeks, months or years. They may disappear as suddenly as they appeared.

Contractures of Toxi-infectious Origin.—In certain infectious diseases or in intoxications contractures present the predominant feature. Such are, for example, tetanus, rabies, poisoning with strychnin, ergot, etc. The reader is referred to the chapters on Intoxications for a detailed clinical description.

Contractures of Peripheral Origin—Reflex Contractures.—They may occur in inflammatory conditions of the limbs, especially of the joints. They are met with in coxalgia, in Pott's disease (immobilization), in angina (trismus), in appendicitis (contracture of the abdominal muscle), in trigeminal neuralgia (facial spasm) and in sciatica (contracture of the pelvic muscles).

Treatment.—In the pseudocontractures in which the disorder is due to a purely muscular irritation, the irritating element should be removed as promptly as possible. Muscular tumors, gummata and foreign bodies should be destroyed by medical or surgical means. Intermittent claudica-

tion which is caused by a local vascular ischemia, occurring intermittently à propos of a muscular effort, is not easily amenable to treatment. However, an effort should be made to remove the causes producing a vasomotor disturbance or an arterial irritation. It was observed that heavy smokers, or users of alcoholic beverages are apt to develop intermittent claudication. The treatment should consist of removing these toxic elements as radically as possible. The mode of living, diet and hygiene should be so regulated as to avoid any condition which is apt to irritate the arterial system, which in these cases is undergoing changes. Gout, arteriosclerosis, syphilis and lead-intoxication should all be borne in mind in the treatment and, if any of these etiological elements is traced, corresponding therapeutics be instituted. Locally, the writer found satisfaction in using Bier's method of artificial hyperemia. A bandage or an elastic is applied immediately above the knee for an hour morning and evening, so as to impede the venous but not the arterial circulation, and this is immediately followed by a local hot bath for a half an hour. This treatment can be kept up indefinitely.

In view of the fact that in intermittent claudication the blood irrigation of the affected limb, while sufficient when at rest, is not sufficient while at work, an increased supply of blood can be obtained by external heat. The patient is therefore advised to keep his limb exceptionally warm by any means whatsoever.

Conditions analogous to intermittent claudication have been observed, when a limb is placed in strongly compressing apparatuses or after ligation of a large artery. The surgeon is therefore reminded of such possibilities and in any given case these etiological factors should be thought of.

The treatment of contractures in organic nervous diseases consists of treatment of the central lesion, such as cerebral hemorrhage, embolism, thrombosis, myelitis, etc. However, local management should not be neglected. Every effort must be made to improve the nutrition and the function of the involved muscles. Massage, systematic exercises and local application of heat kept up regularly for an indefinite time may render great service. The progress may be slow but, if the effort is persisted in, favorable results will follow. A word of caution may be said with regard to the use of electricity. In the experience of the writer the latter increases the rigidity of the muscles with any of the currents. The same remarks are applicable to the contractures of meningeal origin.

The toxi-infectious contractures, such as those due to tetanus, etc., are entirely dependent upon the cause of the original malady and the treatment of the contractures is that of the infectious or toxic process.

Contractures of Parkinson's disease in the light of our present conception of the function of the striate bodies may be viewed as the result of an organic disorder. However, the function of the parathyroid glands as well as the experimental work concerning the calcium metabolism

should be seriously considered. To avoid repetition the reader is referred to the chapter on Paralysis Agitans for a detailed discussion of the treatment. It may be mentioned that the external means suggested for contractures of organic origin may be applied here (see above).

Contractures in hysteria deserve special consideration. It was mentioned above that they occur immediately after an emotion and that the muscles remain fixed in the same state in which the emotion had produced them. It was also said that hysterical contracture is of variable duration, namely, days, or weeks, or longer. It may be added here that an hysterical contracture may disappear as promptly or suddenly as it made its appearance, especially after the application of any of the psychotherapeutic methods. Narcosis is also one of the procedures for removal of hysterical contractures. Esmarch's elastic band may also be of benefit when one limb or a segment of a limb is contracted. Not infrequently an hysterical contracture of a portion of a limb may set in à propos of a peripheral irritation or when the limb is placed in an awkward position and maintained so for a long time. It is therefore advisable to avoid such possibilities and to remove all peripheral irritation in an individual potentially hysterical or neuropathic. It must be borne in mind that hysteria is a psychic affection and its treatment must be carried out along psychic lines. The reader is referred to the chapter on Hysteria for a detailed treatment of this great neurosis.

The treatment of contractures of peripheral origin or of so-called reflex contractures is closely associated with the removal of the irritating factors. Pott's disease, arthritis, angina, appendicitis, neuralgia, sciatica, etc., must all be treated primarily before one can expect amelioration or disappearance of the contracture.

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DISEASES OF THE EYE

CHAPTER XXVII

OCULAR THERAPEUTICS

ARTHUR N. ALLING

EXAMINATION OF THE EYE

It is evident that appropriate measures cannot be intelligently employed in the treatment of disease unless the practitioner has acquired a thorough familiarity with the approved methods of examination in order that he may arrive at an exact diagnosis. It is important, therefore, in the first place, if he would attempt the treatment of the eye, that he himself should have good eyesight and that it should be supplemented at times by the proper instruments. Further, the eye under examination must be well illuminated. It is impossible to make a thorough inspection unless these conditions are fulfilled. The necessary accessories with which the practitioner should provide himself are a lens, an ophthalmoscope and some form of artificial light.

The *lens* should be double convex of two and one-half inch focus. It is used to concentrate the light on the portion of the eye under examination, the method known as oblique illumination. It is also necessary for the indirect method of using the ophthalmoscope and it may be used as a magnifying glass.

The *ophthalmoscope* may be of the reflecting type where the light is obtained from an outside source, or one of the different forms of electric ophthalmoscopes (May, Marple, DeZeng) may be used where the light is furnished by a battery within the instrument itself. There are three ways in which the ophthalmoscope is employed: First, the indirect method where the light is thrown into the eye with the ophthalmoscope held about fourteen inches from the eye under examination and with a + 3 Dioptre lens placed in front of the aperture. The convex lens mentioned above is then held about two inches in front of the patient's eye and the light is reflected into the eye. An inverted image of the fundus will be formed between the lens and the ophthalmoscope. The magnification is about five diameters. Second, the direct method which is employed when it is desirable to obtain a more magnified image (fifteen

diameters). The ophthalmoscope is held as near as possible to the patient's eye and when the light is reflected into the eye an erect image will be seen. If the eye examined is hypermetropic or myopic a correcting lens should be placed in front of the ophthalmoscope until the image becomes clear. Errors of refraction may also be estimated by noting the particular lens with which the fundus is most clearly seen. This method has fallen somewhat into disuse but is of great value. Third, the media may be examined by reflecting the light into the eye with the ophthalmoscope held at some distance from it and opacities may be roughly located, from behind forward, by turning on plus lenses and approaching the eye until, with a + 16 Dioptre, a magnified image of the cornea and iris is obtained. The physician is advised to dilate the pupil in order that the ophthalmoscopic examination may be made more easily, as reflexes are quite troublesome when the pupil is small, especially if a careful examination of the macula is desired. This is satisfactorily accomplished by instilling drops of homatropin, 1 per cent, or using it in the form of disks which are sold for the purpose. Cocain, 4 per cent, is usually quite satisfactory and safer in the aged.

The *artificial light* may be a frosted electric bulb or a gas light in the form of an Argand burner or, best of all, an incandescent gas mantle. It is desirable that a dark room or one that can be rendered moderately dark should be available when oblique illumination and the ophthalmoscope are used.

The physician having equipped himself with these accessories and having learned to use the ophthalmoscope with facility is prepared to carry through an examination and arrive at the diagnosis. In order to do this thoroughly it is desirable to follow a routine unless some salient feature of the case at once draws attention to the lesion and renders further search unnecessary.

The following brief outline suggests various signs which should be looked for:

General Inspection.—Much may often be learned by the appearance and behavior of the patient before the routine examination begins. Patients often fall easily into certain types as, for example, anemic, plethoric, dissipated, syphilitic, tuberculous, neurasthenic. The diagnostician will not fail to take advantage of these observations.

History.—A careful history of the complaints is then obtained and such particulars of the general history as seem likely to throw light on the ocular trouble.

Lacrimal Apparatus.—In emaciated patients the edge of the lacrimal gland may be felt as it lies in its fossa on the upper outer wall of the orbit. Tumors or prolapse should be observed. The presence of excess of tears in the conjunctival sac (epiphora) is indicated by a watery line along the edge of the lower lid and at the inner canthus. Attention

should then be turned to the conducting apparatus, and the small openings (puncta) on the margin of each lid near the inner canthus should be found open and lying against the eyeball. The region overlying the lacrimal sac is next examined for redness and swelling and the finger, with the ball turned toward the nose, is pressed firmly over the lacrimal sac, while the puncta are watched to observe the escape of discharge.

Lids.—The width and length of the opening between the upper and lower lids (palpebral fissure) should be observed as well as any drooping of the upper lid (ptosis). The skin covering the eyelids should be examined for any disease, and for edema, swelling and redness. The margins of the lids should then receive a thorough inspection for the number of cilia as well as their direction, to be sure that no lashes are turned in against the eyeball (trichiasis) and that there is not a double row of lashes (distichiasis). Look also for redness, swelling, discharge, scales, crusts, cysts, ulcers, tumors, pediculi, or ova. The upper or lower lid may be found rolled inward (entropion) or outward (ectropion). One should next investigate the inner surface of the upper lid by turning it. This is accomplished by seizing the eyelashes with a firm hold between the thumb and finger of the left hand, with the thumb below. The patient must then look down, and any smooth instrument, preferably about the size of a match, should be pressed into the skin just under the edge of the orbital ridge. If the instrument is then pressed down folding the skin before it, while the eyelashes are pulled up outside the folded skin, the lid may be turned and held in place for inspection by the thumb which is conveniently present. The inner surface of the lid should be examined as to the condition of the conjunctiva, noting congestion, thickening, granulations, ulcers, or points of discoloration. The inner surface of the lower lid may be examined by placing the finger well up to the edge and pulling down while the patient looks up.

To make a satisfactory examination of the lids and eyeball in young children, the nurse should hold the child's face up so that the head may be held between the surgeon's knees and the lids held open by the fingers or with lid-retractors.

Conjunctiva.—The method of examining the palpebral conjunctiva has just been described. The transition of the palpebral into the ocular conjunctiva (retrotarsal fold, fornix, cul-de-sac) should not be overlooked. The ocular (bulbar) conjunctiva is easily accessible, and congestion, thickening, edema (chemosis), and tumors should be noted.

Conjunctival Discharge.—The physician must learn to distinguish the various forms of discharge in the conjunctival sac:

a. Watery (tears)—found in stenosis of the conducting lacrimal apparatus.

b. Mucous—mucilaginous, but clear—example, chronic conjunctivitis.

c. Mucopurulent—tenacious white or yellow, as in acute or chronic conjunctivitis.

d. Purulent—creamy—runs out of eye when the lids are separated, as in gonorrheal ophthalmia.

It is often desirable to make smears and cultures to determine the presence of bacteria.

Congestion of the Eyeball.—It is extremely important to differentiate between the different forms of congestion of the anterior segment of the eye.

a. Conjunctival.—This form is easily distinguished by the fact that the vessels are movable with the conjunctiva over the eyeball. This may be demonstrated by using pressure with the edge of the lower lid. It is found in conjunctivitis.

b. Ciliary or Circumcorneal.—A fine vessel congestion most intense about the cornea. Pink or violaceous in color. Due to irritation or inflammation in the cornea, iris, or ciliary body.

c. Scleral.—The conjunctiva movable over it. May be localized, fine vessel congestion, or general in form of large vessels which perforate the sclera. Found in scleritis or glaucoma.

Sclera.—The sclera may show congestion, localized swellings, bulging (staphyloma) or areas of discoloration due to scleritis or congenital.

Cornea.—The anterior surface of the cornea should be examined by oblique illumination for irregularities, blood-vessels, foreign bodies, ulcers, blisters, depressions, or opacities. In the deeper layers opacities may be found and they may be dense white (leukoma), or a moderately thick cloud (macula), or a faint opacity (nebula). The posterior surface should also be scrutinized for opacities, usually punctate.

Sensibility of the cornea may be tested by brushing the surface with a wisp of cotton. Normally this is resented by a quick reflex.

Anterior Chamber.—The depth of the anterior chamber should be noted—that is, the distance between the posterior surface of the cornea and the anterior surface of the iris and lens. The clearness of the aqueous humor should be noted as well as the presence of pus and exudate (hypopyon) or blood (hyphema).

Iris.—The anterior surface of the iris is then carefully observed and compared with that of the other eye. The muddy discoloration from congestion which is accompanied by loss of detail in the fine markings of the surface as well as discoloration from the presence of foreign bodies of iron (siderosis) and masses of exudate, tumors or pigment spots will be recognized with a little experience. Quivering of the iris when the eye is moved (iridodonesis or tremulous iris) is sometimes seen when the lens is absent or dislocated.

Pupil.—The pupil should be circular, nearly in the center of the iris, and the same size as that of the other eye. The reaction of the pupil to light may be roughly tested by alternately covering and uncovering the eyes with the hands. A better way is to throw the light by oblique illumination into and out of the eye, in a dark room. The pupil into which the light is thrown should contract (direct action) and the other should do so as well (consensual action). When the patient looks from distance to a near object, the pupil should also contract (reaction to accommodation and convergence).

Lens.—The crystalline lens may be examined partially by daylight or better by oblique illumination as far as the size of the pupil will permit. Its fixity of position should be determined, for dislocation would be evidenced by iridodonesis or by the fact that the edge can be seen, which is never the case under normal conditions.

Opacities (cataract) are discovered by oblique illumination or the ophthalmoscope.

Vitreous Humor.—That part of the vitreous chamber which lies just back of the lens is accessible by daylight and should be perfectly clear. The deeper parts of the vitreous are examined by the ophthalmoscope.

Orbit.—The finger should be passed about the bony edge of the orbit and pushed well back inside about the eyeball for the detection of tumor masses.

Eyeball.—Note the position of the eyeball as to undue prominence (exophthalmos, proptosis) or recession into the orbit (enophthalmos), and as to whether it is pushed to one side or the other. Also whether the eyeball is larger (megalophthalmos) or smaller (microphthalmos) than the normal size.

Fundus.—The ophthalmoscope opens to one's view a little more than the posterior hemisphere of the internal surface of the eyeball. The optic nerve head should first be brought into view and congestion, pallor, swelling, cupping, or blurred outlines noted. The macula should be examined for lesions. Attention is then turned to the general appearance of the fundus, the size and tortuosity of the vessels and the presence of blood, white patches of exudate, or degeneration, or exposed sclera and black patches of pigment either retinal or choroidal. Detachment of the retina and tumors are noted.

Tension.—The tension of the eyeball may be roughly estimated by using slight pressure with the two forefingers through the upper lid while the patient is looking down. It may also be accurately determined by the use of an instrument known as the tonometer (Schiötz, Gradle, McLean).

Vision.—The sense of sight is divided into: (1) form-sense (acuity of vision); (2) color-sense; and (3) light-sense.

The form-sense may be classified as (*a*) direct or central vision, and (*b*) indirect or peripheral vision.

1. *a. Acuity of Vision.*—Snellen's test card is usually employed. The patient is told to read the letters beginning with the largest and the number of the line of the smallest letters which he reads should be placed as the denominator of a fraction, the numerator being the number of feet at which the card is placed from the patient. For example, if the number of the line of smallest letters read is forty and the distance of the card twenty feet, the record would read, V = 20/40. When the vision is so poor that the largest letter cannot be read at twenty feet, the patient is asked to count fingers as examiner slowly approaches. In testing the accommodation the nearest point at which the fine print can be read forms the record.

b. Indirect Vision or Field of Vision.—The area of more or less distinct vision about the object of fixation is called the field of vision. The angular distances from the line of fixation at which objects can be seen on all sides must be estimated. This may be done roughly by asking the patient to fix upon a point directly in front and by observing when he first notices the hand or a small white object which is moved from the extreme periphery toward the object of fixation. The normal limits are approximately: on the temporal side 95°, nasal 65°, above 65°, and below 70°. More accurate records can be obtained by the use of the perimeter. Examinations should include not only the limits of the field but also the presence of defective areas which are often found at the macula (scotomata).

2. *Color-Sense.*—A defect in the color perception may be either congenital or acquired. The best method of testing color perception is by the use of skeins of colored worsted (Holmgren's test). For railroad and marine employees lanterns showing colored lights are employed, duplicating working conditions. In some cases it is desirable to note the limits of the fields for different colors and also whether or not the central color vision is normal.

3. *Light-Sense.*—This is the power of the eye to appreciate variation in the intensity of illumination. Diseases of the fundus sometimes affect the light-sense.

Muscles.—Only the external muscles are included under this caption. The limits of excursion of each eye should be noticed while it follows the finger in every direction, and paralysis or paresis noted. There should be no deviation of either line of vision from the object of fixation (strabismus).

The practitioner should not be content simply with the diagnosis of the disease at hand but should attempt to ascertain its underlying cause. Many eye diseases depend upon some disturbance in the bodily condition

and local treatment alone may not be sufficient to effect a cure. For example, to treat locally an attack of recurrent iritis is quite imperative, but unless an attempt is made to discover the source of the toxemia which causes the attacks, he has sadly failed in his duty. It is desirable, therefore, in certain cases, that an examination of the blood, circulatory system, urine, teeth, nose, tonsils, accessory sinuses, and digestive tract be made. Tuberculin diagnostic test, X-ray examinations, etc., may be necessary.

OCULAR THERAPEUTICS

Bandaging of the Eyes.—This is helpful in many cases but where there is discharge it is best not to confine it. Instead of the roller bandage a small piece of gauze, covered by a pad of cotton and fastened with court-plaster or surgeon's plaster, makes a suitable dressing, especially after operation, when no pressure is desired. Eye pads and shields are also available.

Heat and Cold are applied by means of pads taken from boiling water or ice. Indications cannot be stated exactly. Cold is used in acute affections of the lids, conjunctiva, and traumatism, but heat in the diseases of the cornea, and the interior of the eye. Fomentations are only used when it is desirable to promote suppuration.

Leeches are occasionally applied to the temple in cases of severe congestion.

Electricity is used as electric cautery, and electrolysis for misplaced eyelashes. The galvanic and faradic currents have been employed in various conditions, but have little but psychical effect.

Vaccines and Antitoxins.—Gonococcus vaccines are useful in metastatic iritis and conjunctivitis but are of less value in gonorrheal conjunctivitis. Autogenous or stock vaccines are employed in ulcers and infections. Diphtheritic antitoxin should be used in diphtheritic conjunctivitis and also has given good results in infectious processes. Injections of sterilized milk, 5 to 10 c.c., have proved of value in ulcers and infections.

Tuberculin is used for diagnostic purposes (¼ mg. of T.O. subcutaneously), watching for general and local reaction. Von Pirquet's (vaccination) test is of little significance except in young children, since it is generally positive in adults. Treatment with tuberculin is made use of by ophthalmologists in tuberculous manifestations of the eye when there are no active processes in other parts of the body. T.R. and B.E. are usually employed, 1 : 10,000 mg. repeated every few days in increasing doses. The general practice is to keep the dose at a point just below that found necessary to produce reaction.

Drugs.—Cleansing and soothing lotions are constantly employed in the treatment of the eye and should be used freely to be effective. The

best method is to saturate a piece of cotton and allow the solution to flow over the conjunctiva and eyeball. The popular eye cup is undesirable, as infection may be carried from the skin to the eye. Mild solutions are boric acid (4 per cent), salt solution (0.6 per cent), sodium biborate (2 per cent), sodium bicarbonate (1 per cent).

Astringents are used in various forms of conjunctivitis; those commonly employed are: zinc sulphate (0.33⅓ per cent); zinc chlorid (0.25 per cent); tannic acid (1 per cent); alum (½ per cent) or alum crystal; nitrate of silver (½ to 1 per cent), applied with cotton applicator; copper sulphate crystal.

Antiseptics.—Organic salts of silver are very popular. Argyrol (20 per cent), protargol (10 per cent), silvol (10 per cent). While the germicidal action is weak or doubtful, they seem to act beneficially in conjunctival diseases, wounds and ulcers. They serve at least to cleanse the eye. On account of their great specific gravity, the lighter discharge will float more readily out of the conjunctival sac. A word of caution should be spoken regarding the continual use of these drugs, since they will, like nitrate of silver, produce indelible argyrosis if used over long periods. Prescriptions should therefore be written "Not to be refilled." Bichlorid of mercury is a powerful antiseptic and is used in the eye in solutions from 1:5,000 to 1:10,000. Nitrate of silver is a most effective antiseptic as well as astringent used in solution (½ to 2 per cent).

Mydriatics and Cycloplegics.—Mydriatics dilate the pupils, cycloplegics paralyze the accommodation. Atropin and allied drugs affect both the sphincter pupillæ and the ciliary muscle. They are used principally in iritis, cyclitis and corneal lesions. Cocain and euphthalmin dilate the pupil but have little influence on the accommodation. Atropin sulphate (½ to 1 per cent) is a powerful drug and should be used only when indications are clear. Certain individuals are susceptible to its toxic effects and from small doses taken internally will show constitutional symptoms and dilatation of the pupil. Even a belladonna plaster will occasionally give this reaction. Constitutional symptoms are also sometimes observed from absorption of the drug dropped in the eye. Another toxic effect is dermatitis of the lids. In these cases one of the other allied drugs may sometimes be successfully substituted. As atropin has a tendency to increase intra-ocular pressure, it must not be employed in cases where tension is elevated; in fact it is wise not to use it in patients past middle life unless indications are urgent and the intra-ocular tension frequently tested. Homatropin hydrobromate (1 to 2 per cent) acts more quickly than atropin and its effect passes off in a few hours. It is used to paralyze the accommodation in testing refraction. Duboisin sulphate (½ per cent), daturin (½ per cent), hyoscin hydrobromate (½ per cent), and scopolamin hydrobromate (¼ per cent), are other drugs

which may be substituted for atropin. Euphthalmin (5 per cent) is used to facilitate ophthalmoscopic examinations.

Myotics.—Pilocarpin hydrochlorate (½ to 1 per cent) is a stimulant to the sphincter pupillæ and ciliary muscle and tends to reduce the intra-ocular pressure. The same may be said of eserin (¼ to ½ per cent), which is more powerful but apt to produce some pain and congestion of the iris.

Local Anesthetics.—Cocain hydrochlorate (4 to 8 per cent) is used to anesthetize the conjunctiva and cornea preparatory to operations or to allay irritation. It may also be employed for subconjunctival and subcutaneous injections, usually in 1 per cent solutions. As it has a tendency to dry the corneal epithelium, the eye, during extended operations, should be moistened occasionally with some mild solution (boric acid). It has a tendency to reduce the intra-ocular pressure. Its solutions cannot be thoroughly sterilized as prolonged boiling reduces their strength. Holocain hydrochlorate (1 per cent) is an excellent substitute. It does not dilate the pupil or dry the cornea; furthermore, it may be sterilized, but it must not be used subcutaneously on account of the toxic effects. Novocain, eucain b, butyn and stovain are other local anesthetics.

Dionin (ethylmorphin hydrochlorate) (5 per cent) is an analgesic, and when dropped into the eye produces a marked edema of the bulbar conjunctiva (chemosis). The patient sometimes sneezes a few moments after instillation. It seems to act as a lymphogogue and as an adjuvant to other drugs. Adrenalin chlorid, though not an anesthetic, is used to aid the absorption of other drugs. It blanches the conjunctiva and is useful to prévent bleeding during operations.

X-ray.—The X-ray is employed not only in diagnosis but in the treatment of malignant growths and has been tried in other lesions with more or less success. The same may be said of radium.

Ointments.—Instead of aqueous solutions, drugs may at times be administered in the form of ointments usually made up with vaselin. Among the usual prescriptions are: boric acid (2 per cent); yellow oxid of mercury (1 per cent); iodoform (1 per cent); ammoniate of mercury (1 per cent); bichlorid of mercury (1:5,000). They are used as antiseptics and stimulants.

Fluorescin.—This is used to stain abrasions and ulcers of the cornea in the strength of 2 per cent in a 4 per cent solution of bicarbonate of soda.

Subconjunctival Injections.—A few drops of sodium chlorid are sometimes used for injections under the ocular conjunctiva in cases of deep-seated inflammation and retinal detachment. Bichlorid of mercury (1:5,000) or cyanid of mercury (1:5,000) are also used but cause more pain.

The indication for the use of local remedies is generally quite clear

and most of the drugs employed have definite, specific action. It is rarely necessary, therefore, to resort to empiricism and the physician is warned against the use of new and untried drugs however cleverly they may be exploited. It is best also to make use of the simplest prescriptions, for the length of the prescription is usually inversely proportionate to the accuracy of the diagnosis.

DISEASES OF LACRIMAL APPARATUS

Lacrimal Glands.—Diseases of the lacrimal glands are so rare that they need only to be mentioned. Occasionally the glands are acutely enlarged in connection with the parotid and submaxillary (Mikulicz's disease). It is also the seat of tumors and very rarely it prolapses.

Conducting Apparatus.—Lacrimation is occasionally observed in infants, associated with mucopurulent discharge, which is the result of conjunctivitis produced by poor drainage and consequent infection.

Treatment.—Treatment of this condition should be confined to the conjunctiva because the nasal lacrimal duct, which has not yet become patent in the development of the skull, will later, without doubt, open. It is meddlesome surgery to open the canaliculus or duct except in rare cases of dacryocystitis, which is evidenced by a fluctuating tumor at the inner angle of the lids with or without inflammatory signs. In the adult, especially in later years, epiphora is caused by an eversion of the punctum as a result of hypertrophic conjunctivitis or a narrowing of the nasal duct. For the alleviation of this symptom it is best to institute a course of treatment for the conjunctivitis which in some cases will prove quite satisfactory. If, however, these measures fail to yield results, it is advisable to enlarge the punctum which is misplaced or much contracted. This slight operation is easily performed under cocain anesthesia. One blade of a scissors, with extremely fine points, should be introduced into the punctum of the lower lid, downwards at right angles to the edge of the lid because the canaliculus takes this course at first for a millimeter or two. The cut is then made and may be enlarged by extending it at right angles in the canaliculus toward the inner canthus.

Chronic Dacryocystitis.—This disease is accompanied by epiphora, chronic conjunctivitis and a fluctuating tumor over the site of the lacrimal sac. If pressure is applied over the sac while the lower lid is turned out, a mucopurulent discharge will be forced out through the punctum. The reason for this is that the nasal lacrimal duct is closed and there is no other escape for the fluid. Microscopic examination of the discharge will usually show the pneumococcus.

Treatment.—As the hypertrophy of the mucous membrane of the nasal duct has produced stenosis, nothing but surgical interference will have

the slightest effect. No medication can be introduced to reach effectively the site of the stricture. Some patients, who refuse surgical treatment, may be fairly comfortable if taught to express, at frequent intervals, the discharge which collects in the sac and if they use some antiseptic lotion. Better results will be obtained, however, if the punctum is enlarged and the canaliculus slit to facilitate drainage. More radical treatment looks toward cutting of strictures. The old method of forcing a passage and passing a silver style, which is left permanently in place, is now wholly abandoned and most ophthalmologists try to dilate the strictures by passing probes through the duct into the nose. The method of procedure is as follows: A lacrimal knife is introduced into the punctum and pushed into the lacrimal sac, taking care that the knife at first is rotated so the cutting edge is turned as far as possible inward away from the edge of the lid so that the slit may lie against the eyeball. When the lid is in place the slit forms a canal instead of a gutter as would be the case if the incision were made along the free edge of the lid. When the probe point of the knife is in the sac, it should be pressed against the lacrimal bone and the handle of the instrument raised to a vertical position. If the shank of the knife is then held against the superorbital ridge and directed downward toward the ala of the nose, no difficulty should be experienced in engaging the opening of the duct. The knife is then pushed boldly into it, thus cutting the strictures. After cutting the strictures, the largest size lacrimal probe should be introduced in the same manner and left in place for a few minutes. If the probing is repeated in a few days and then with increasing intervals, the results will be quite satisfactory in many cases. The objection to this method is that it is painful and general anesthetic is impracticable. Only a certain proportion of patients will display sufficient fortitude to return regularly for the prescribed treatment and, unless probing is repeated, the first opening of the duct usually produces no permanent results and may even cause more resisting strictures. Another reason why the treatment may be unsatisfactory is that in some cases the strictures are so fibrous in character that the duct immediately closes after each probing. The most effective method of dealing with dacryocystitis is by extirpation of the lacrimal sac in its entirety. This operation is indicated in cases when other methods have failed or when an operation upon the eyeball is contemplated, for the presence of infection in the lacrimal sac is very liable to infect an operative wound. Before attempting this operation, the surgeon should familiarize himself with the technic as described in works on ophthalmic surgery.

Acute Dacryocystitis.—Abscess of the lacrimal sac is an acute, purulent inflammation which may occur at any time during the course of a chronic dacryocystitis. Its signs are redness, swelling and pain. It should not be confused with erysipelas. The process is due either to a lighting up of an infection already present or to the introduction of new patho-

genic bacteria. The process, which begins in the lacrimal sac, extends to the cellular tissue about it and an abscess is formed. In a short time pus will appear under the skin over or below (rarely above) the lacrimal sac.

Treatment.—If the abscess is not opened it will rupture spontaneously through the skin. Healing may then take place, but another abscess is likely to form later or the opening may not entirely heal, but a permanent fistula remains through which tears may be pressed from the sac. In the first stages when tenderness and swelling are slight the process may sometimes be aborted by applying ice-cold cloths at frequent intervals. At this time it is sometimes possible to open the punctum and slit the canaliculus, as has been explained above, so that free drainage may be established. If swelling and pain have increased and it is thought that an abscess is forming, it is best to encourage the breaking-down process by applying fomentations. In a day or two a yellowish appearance underlying the skin is a sure indication that incision should not be delayed. A scalpel is introduced at the lower edge of the tumor and plunged to the lacrimal bone, cutting upward so as to make a very free incision at least one-half inch in length. A gush of pus will follow. The wound is then syringed thoroughly with boric acid solution (2 per cent) or bichlorid of mercury (1:5,000) and should be packed rather tightly with sterile or iodoform gauze. Daily dressings are necessary until the pus and swelling have disappeared. The opening usually closes, although it may be necessary to cauterize the wound and cut out granulations that have formed. The case should then be treated as a chronic dacryocystitis.

DISEASES OF THE EYELIDS

Blepharitis Marginalis.—Under this head are classified all grades of inflammation involving the lid margins, from the hyperemia, so common in individuals of blond complexion, to cases in which the edges of the lids are covered with scales and scabs. In the worst form the hair follicles are destroyed and the fallen lashes will not be replaced. If the dried discharge which mats the lashes together is not removed, the lid margin will become ulcerated. A chronic conjunctivitis is a most constant accompaniment of this affection, and indeed is often its cause, especially if the eyelids are not kept well cleaned. It is most common in children and may accompany or follow the exanthemata.

Treatment.—Treatment should be directed toward improving unsanitary conditions. Patients who are exposed to bad air, smoke, or dust should avoid these irritants and those who do not practice cleanliness should be admonished. The milder cases sometimes exhibit a tendency toward hyperemia through a lifetime. Lack of sleep, exposure to wind or dust, or eye-strain will redden the lids. A mild ointment (boric acid,

2 per cent, or yellow oxid of mercury, ½ per cent) rubbed into the roots of the lashes at night, with the correction of any error of refraction and more regular mode of life, will accomplish all that is possible. The severer cases, where crusts are found at the edge of the lids, are inexcusable. If the discharge tends to collect at the lid margins as an accompaniment of a conjunctivitis, it may be prevented by the use of some oily substance such as vaselin or the ointments mentioned above. Hence no case, if properly treated, should advance to the ulcerative stage. When the patient presents himself with dried secretion in evidence, he should be instructed to soften it with soap and water or with a solution of borax or bicarbonate of soda until the lashes are entirely clean, in spite of the fact that the ulcerating areas may bleed slightly. It is quite useless to apply remedies to the scabs. When the lids are clean, yellow oxid of mercury ointment (2 per cent) or ammoniate of mercury ointment (1 per cent) should be applied two or three times a day, or the physician may apply nitrate of silver (1 per cent) to the ulcers every day or two. Appropriate remedies should also be prescribed for the conjunctivitis.

Phthiriasis Palpebrarum.—The crab-louse (pediculus pubis) is occasionally found with its head buried in the lid margins and the brown nits on the lashes may be easily overlooked as they resemble secretion. The parasites may be picked out or killed with yellow oxid of mercury ointment (2 per cent).

Syphilis of the Lid.—This is rare. Primary sores have been observed. They show characteristic signs and are accompanied by enlargement of the preauricular and submaxillary glands. Ulcerations of the secondary stage are possible and gummata are occasionally seen. The treatment is obvious.

Vaccinia (vaccine pustule).—This is of rare occurrence. Mild antiseptic applications are indicated.

Herpes Zoster Ophthalmicus.—This disease affects the area supplied by the ophthalmic branch of the fifth nerve. The eruption appears in the form of vesicles on the forehead, eyelids and the side of the nose and is accompanied by neuralgic pain. Anesthesia is sometimes found over the affected area. The vesicles leave scars and the cornea may also be involved as well as the deeper parts of the eye (iritis, cyclitis), in which case the ulcers may leave opacities which permanently affect the vision. This disease is frequently mistaken for erysipelas.

Treatment.—Talcum powder or stearite of zinc is applied until the vesicles break, after that boric acid ointment (2 per cent).

Hordeolum (stye).—This is a suppurative inflammation of one of the glands, which are so numerous, at the edge of the lids—Zeiss (sebaceous) and Moll (modified sweat).

Treatment.—When the first signs appear it is sometimes possible to stop the process by ice applications, but fomentations are soon indicated

to hasten the formation of the pus, which will appear as a yellowish spot. An incision then hastens recovery. As styes are apt to recur, yellow oxid of mercury ointment should be rubbed into the roots of the lashes two or three times a day as a preventive. Measures should be directed toward the improvement of the general condition of the patient. Autogenous vaccines may also be tried.

Chalazion.—A chronic, proliferating inflammation of a Meibomian gland. It appears as a round tumor in the tarsal plate, showing a dark spot on the inner aspect of the lid, with the skin freely movable over it. The center soon breaks down into fluid and later it becomes entirely cystic (Meibomian cyst).

Treatment.—In some cases a chalazion will disappear spontaneously or it may discharge, usually on the conjunctival surface, and granulations appear about the opening. If the tumor does not disappear with treatment by fomentations and massage, it may be treated by making a vertical incision, under a local anesthetic, into the dark spot on the conjunctival side and scraping out the contents with the small curette. It is necessary to do this thoroughly because otherwise it may recur. The cavity immediately fills with a blood-clot, which soon resolves. A better method is excision of the tumor through the skin. A few drops of novocain (1 per cent) or of cocain (1 per cent) in adrenalin solution 1:5,000 are first injected into the skin and a lid clamp so adjusted that the lid is compressed and the tumor lies between the clamp. A horizontal incision is then made through the skin and the orbicularis muscle. The tumor will present as a smooth, round mass, which may be enucleated with a scissors. One or two fine sutures close the wound and a light dressing is applied. It is thought by some that correction of errors of refraction aids in preventing the recurrence of styes and Meibomian cysts.

Entropion.—There are two forms of entropion, cicatricial and spastic.

In the first case the inversion of the lid is due to cicatricial contraction of the conjunctival surface. The scars in the majority of cases represent the last stages of trachoma, although burns and other injuries of the lids may produce it.

The second or spastic form is usually a senile condition.

Treatment.—The most distressing accompaniment of entropion is trichiasis or the rolling in of the lashes. This condition may be temporarily relieved by the epilation of the lashes but, as the hair follicles are not destroyed, the lashes will grow again and are sometimes more irritating when short. The hair bulbs may be destroyed by electrolysis, but this method is painful and tedious. Operation is the only practical cure. When only a part of the lid is involved, the lashes may be turned outward by making punctures in the skin with the electric cautery, for the contraction will tend to roll the lid outward. More extensive operations for cicatricial entropion are described in works on ophthalmic surgery. The

operation for spastic entropion, however, is simpler and may be described here. The skin of the lid should be thoroughly cleansed, and after the subcutaneous tissue has been infiltrated with an anesthetic, cocain (2 per cent) or novocain (1 per cent), an incision is made in the skin parallel to the lower lid margin and about 4 or 5 mm. from the edge, from one end to the other. A second, curved, incision should then be made, beginning at each end of the first and including about 5 or 6 mm. of skin at the widest point. The skin within these incisions with the underlying orbicularis muscle is then excised and the wound is stitched together with fine silk sutures. A light dressing should then be applied. The success of the operation will depend upon the judgment of the surgeon, who must remove enough skin to produce the effect and not enough to cause ectropion.

Ectropion.—Rolling out of the eyelid is caused by hypertrophy of the conjunctiva and usually affects the lower lid. It is also the result of cicatrices, wounds, burns, etc. Paralysis of the facial muscles causes a mild form. The eversion of the punctum in ectropion causes epiphora and this in turn aggravates the conjunctivitis. Ectropion conjunctivitis presents an unsightly appearance.

Treatment.—The cases which are due to a thickened conjunctiva may often be successfully treated by the application, to the exposed membrane, of nitrate of silver (2 per cent) every other day for not longer than one month for fear of argyrosis. This is sufficient for the milder forms, but a strip of conjunctiva should be excised in the more marked cases. It is also proper to cauterize the conjunctiva with the actual cautery. Enlargement of the punctum is also indicated. The severer forms, especially those produced by cicatrization of the skin, are treated only by plastic operations.

Ptosis.—The falling of the upper lid is either congenital or acquired. The former is due to an undeveloped levator muscle and the acquired form to paralysis of the branch of the third nerve supplying the muscle. It may be associated with paralysis of other branches.

Treatment.—Treatment of the congenital form is operative. The principle underlying most operations for ptosis is that the upper lid should be attached to the occipitofrontalis muscle so that it may act in place of the levator. The practitioner should not attempt these operations without special training. The acquired form is often syphilitic and should be treated accordingly. If due to some brain lesion, this sign, like many other ocular manifestations, is an important aid in diagnosis.

Blepharospasm.—Slight twitching of the lid is extremely common and of no significance. Clonic contraction of the orbicularis is quite common in children, due either to irritation produced by a follicular conjunctivitis or as a choreal manifestation. Spasmodic tic involves the muscles of the lid as well as those of the face. Contractions may be painful (tic doulou-

reux). The treatment of these affections, except those produced by conjunctival irritation, is very unsatisfactory.

Tumors of the Lid.—*Xanthelasma* appears as chamoislike patches in the skin of the lid in elderly persons. They usually come on the nasal side of the upper lid and slowly increase in size, while other patches are forming on the lower lid and (rarely) all about the eye. The simplest method of dealing with these growths, is excising them and bringing the skin together with fine sutures. If they are so large that the traction in suturing the wound will misplace the lid margin, Thiersch grafts must be employed.

Carcinoma.—This disease, sometimes known as rodent ulcer or basal-celled carcinoma, affects the aged, beginning as a small nodule, which later breaks down. About the ulcer indurated nodules will be found. Although the ulcer may cicatrize in places, it slowly increases in size and knows no limits. The starting point may be in a senile keratosis and it is safer to remove such growths. It gives rise to no metastases.

Treatment.—The treatment of rodent ulcer should be instituted while it is small. The simplest method is to excise it with a moderate amount of healthy skin. However, if the ulceration has been allowed to gain considerable size, it will be necessary to slide a flap of skin in order that the lid may not be distorted by traction. Blepharoplastic operations require much experience. The application of X-ray or radium may be quite satisfactory, but the excision of the ulcer is advocated as the simplest and surest cure. The use of caustics cannot be too strongly condemned. Whereas their liberal application will undoubtedly destroy the malignant tissue, their action is difficult to confine.

Injuries of the Eyelid.—Wounds are of importance because of the deformity which may follow the contractions.

Treatment.—The wound should be closed with interrupted sutures both on the skin and on the conjunctival side if the wound extends through the thickness of the lid. Especial care must be taken to bring the wound together at the edge of the lid, otherwise a notch is very likely to result.

The advisability of using tetanus antitoxin should be borne in mind in cases where the wound might be infected.

Ecchymosis.—This is a common result of contusion and may also occur in the lower lid in fracture of the base of the skull.

Treatment.—Cold should be applied if seen early, fomentations later.

Interstitial Emphysema.—The eyelids may become infiltrated with air if there is a fracture of the inner wall of the orbit. When the nose is blown the air is forced out under the skin. One or both lids are swollen and crepitation is felt under the fingers.

Treatment.—The swelling will disappear under a pressure bandage.

DISEASES OF THE CONJUNCTIVA

Acute Catarrhal Conjunctivitis.—This disease is characterized by redness and swelling of the palpebral conjunctiva, with congestion extending on to the bulbar conjunctiva in the form of large vessels. There is usually considerable secretion—in the mild cases, mucous; in the severe, mucopurulent. Except for those cases which are due to mechanical irritation, as from dust, wind, or light, the cause is some sort of bacterial infection and a smear should be taken to determine the character of the germ. The pneumococcus, Koch-Weeks bacillus, staphylococcus, streptococcus, influenza bacillus and Morax-Axenfeld bacillus may be mentioned. If both eyes are not affected at the same time the inflammation usually passes from one to the other. The patient complains of burning, smarting, and sensation of a foreign body. There is no actual pain.

Treatment.—The form known as "pink-eye" is very contagious. The patient should therefore be warned against the danger of spreading the disease, for example, in the use of towels. The first essential in the treatment of this affection is the frequent cleansing of the conjunctival sac so that the discharge does not accumulate. For this purpose the eye should be irrigated every hour or so with a saturated solution of boric acid. In order to allay reaction, ice-cold applications are employed frequently, as will be described under Ophthalmia Neonatorum. Argyrol (20 per cent), silvol (10 per cent), or protargol (5 per cent) should be dropped into the conjunctival sac in generous quantities. It is well to apply vaselin, boric acid ointment or bichlorid ointment (1 : 5,000) inside the lids and along the edges after each treatment and especially the last thing at night to prevent the lids from sticking together. Acute conjunctivitis is a self-limited disease, yet the tendency to leave behind a chronic conjunctivitis, perhaps of the follicular type, should not be lost sight of. The most essential part of the treatment, therefore, is to prescribe an astringent after the acute symptoms have subsided. Sulphate of zinc (1/3 per cent) in boric acid solution, or alum (1 per cent solution) may be used for this purpose.

Chronic Catarrhal Conjunctivitis.—This is a very common affection characterized by more or less congestion and hypertrophy of the conjunctiva. The patient complains of burning, itching, smarting, lacrimation, photophobia, sensation of a foreign body, discharge, which sometimes sticks the lids together at night, heaviness of the lids, sleepy feeling especially in the evening and aching of the eyeballs. The symptoms are more aggravated under artificial light. It is distinctly chronic with exacerbations. The symptoms are caused or aggravated by exposure to wind, dust, smoke, bright light and by insufficient sleep and overuse of the eyes.

Treatment.—This consists in the removal of the irritant and the in-

stillation of some form of astringent. Mild lotions as boric acid or borax give comfort during the more active periods. Zinc sulphate (⅓ per cent), zinc chlorid (⅓ per cent), tannic acid (1 per cent) and application of alum crystal once or twice a day are useful. Nitrate of silver (1 per cent) applied by the physician every other day is effective. Sulphate of copper may be rubbed on the lids every other day when the conjunctiva is much hypertrophied. It is essential that the patient be acquainted with the chronic nature of this disease and that treatment be extended over a long period, interinitting the astringents with milder lotions.

Follicular Conjunctivitis (Follicularis).—This is a chronic affection most common in children, showing as a rule few inflammatory signs, but characterized by the presence of small translucent bodies arranged in rows. They appear more especially on the lower conjunctiva toward the temporal side and in each extremity of the tarsal plate of the upper lid, but they may cover the entire surface. In many cases patients do not complain of any discomfort, but there may be itching, burning, photophobia, and the sensation of a foreign body. The more marked cases are easily confused with follicular trachoma, but it is commonly agreed that there is a difference, because the trachoma granulations turn to cicatricial tissue, while follicular conjunctivitis disappears without a trace.

Treatment.—The treatment is the same as for chronic catarrhal conjunctivitis, but it is sometimes desirable to express the granulations, if they are abundant, with the trachoma roller forceps.

Ophthalmia Neonatorum.—This is a purulent inflammation of the newborn usually due to the gonococcus of Neisser, either acquired during parturition or indirectly by the use of dirty linen, etc. Sometimes other germs are the cause, such as the colon bacillus or the pneumococcus. The onset, if the infection is acquired at birth, is from the first to the third day. Both eyes are affected in the great majority of cases. The lids are at first swollen and reddened and the conjunctiva is edematous, sometimes later being covered by a false membrane. The secretion, which in the beginning is serous, soon turns to pus, which pours out of the conjunctival sac like cream. Swelling of the lids diminishes, but the discharge continues for two or three weeks, when the conjunctiva is apt to pass into a chronic condition of papillary swelling. It is then thick and covered with fine granulations. The serious danger attending this disease is ulcer of the cornea. Ulcers may appear at any place on the cornea, beginning as a gray infiltration which soon breaks down. They spread both superficially and into the depths of the cornea and, unless treated, will perforate. At best a corneal opacity is left, but in the cases where they perforate the eye may be lost through intra-ocular inflammation.

Treatment.—After the birth of the child the eyes should be washed with boric acid solution and a 1 or 2 per cent solution of nitrate of silver should be gently applied to the conjunctival surfaces with a cotton ap-

plicator. This is known as the Credé method, and its employment has greatly reduced the prevalence of ophthalmia neonatorum, so that cases are infrequent in lying-in hospitals; in fact this practice is now required by state laws. If treatment of this disease is instituted before ulcerations have appeared, the prognosis is extremely good. The essential thing to bear in mind is that the discharge must not be allowed to collect in the conjunctival sac. In order to cleanse the eyes they should be irrigated with some bland or mildly antiseptic solution such as boric acid or bichlorid of mercury 1: 10,000, using swabs of cotton. Great care must be exercised during this procedure, for if the corneal epithelium is abraded the denuded area will be attacked by the organisms and an ulcer will result. The interval between the cleansings depends on the amount of discharge, it often being as short as every half hour. After the eye has been thoroughly cleansed a few drops of argyrol (20 per cent), silvol (10 per cent), or protargyrol (10 per cent) are instilled and ice-cold compresses are applied. The proper method of using the cold is to place a number of small pads of cotton on a block of ice. When they are thoroughly chilled one of the pads is placed over the lids and allowed to remain only so long as it continues cold, perhaps half a minute, when it is exchanged for a fresh pad. Ice compresses should be applied day and night about half the time in severe cases, say every other fifteen minutes. The danger of continuous application is the reduction of the vitality of the tissues. Between cleansing and the applications of cold, plain sterile vaselin or bichlorid of mercury ointment (1 : 10,000) is introduced between the lids. Lastly, once or twice a day, during the period of copious discharge, a solution of nitrate of silver, 1 per cent, should be brushed across the conjunctiva of the upper and lower lids. It is well also to continue in this way during the stage of papillary swelling, although as the case improves other astringents such as zinc or alum are sufficient. In general, indications for nitrate of silver are discharge and hypertrophy of the conjunctiva. If ulcers appear atropin (½ per cent) three times a day is instilled, and the ulcer may be touched with nitrate of silver or tincture of iodin once or twice a day. Application of pads from water near the boiling point may be used later, especially if the swelling has subsided. They should be frequently changed so that the temperature is kept as hot as can be borne without injury to the skin. Finally, nurses should be instructed concerning the nature of the disease and its contagious character so that proper precautions may be taken.

Gonorrheal Ophthalmia—Purulent Conjunctivitis in the Adult.—This disease runs a course similar to that of ophthalmia neonatorum but the prognosis is much less favorable. It usually affects but one eye unless the contagion is carelessly transferred to the other.

Treatment.—The first precaution to be taken is the protection of the other eye if not already involved. To accomplish this an inch hole is

cut in adhesive plaster about four inches square and a watch glass fitted into it. The plaster is then applied over the eye (Buller's shield). This affords protection and at the same time allows free inspection. The treatment is the same as for ophthalmia neonatorum except that sometimes the swelling of the lids may require the cutting of the outer canthus in order that they may be separated sufficiently to obtain access to the conjunctiva and to prevent pressure on the cornea. Leeches to the temple may be used to reduce the inflammatory signs.

Metastatic Gonorrheal Conjunctivitis.—Like arthritis and iritis, a mild congestion occasionally appear in the course of gonorrhea. No gonococci are found. The treatment is that of acute or subacute conjunctivitis.

Diphtheritic Conjunctivitis.—This is very rare and is characterized by deep infiltration of the conjunctiva, marked by the boardlike swelling of the lids and a false membrane. The preauricular and submaxillary glands are enlarged. There are constitutional symptoms of diphtheria and there may be involvement of other mucous membranes. Necrosis of the conjunctiva sometimes takes place.

Treatment.—Injections of antitoxin and the same treatment as for gonorrheal conjunctivitis are indicated.

Croupous Conjunctivitis.—This is characterized by a false membrane which is superficial, in this respect differing from the infiltration of diphtheritic conjunctivitis. Furthermore, constitutional symptoms are absent. Croupous membranes may be associated with any form of severe conjunctival inflammation.

Treatment.—This is the same as for acute conjunctivitis.

Trachoma.—This is a chronic affection of the conjunctiva of the lids caused by some unknown germ. A protozoan organism found in the epithelial cells has been described by Halberstadler and Prowazek. Its significance in trachoma is not established since it is found in follicularis and other conditions. Trachoma is more common abroad. In this country it is prevalent among the Russians, Irish, Italians and Polish Jews, but it has appeared among the native Indians and Americans in sections of the middle West. Negroes are practically exempt. The most characteristic sign is a roughened and granular appearance of the conjunctiva. The roughness of the conjunctiva is of two sorts: (1) A papillary granulation, in which case the elevations are really hypertrophied conjunctiva which appears reddened, thickened and velvety. This form of granulation is not specific for trachoma alone, but may be found, for example, after gonorrheal ophthalmia. (2) True trachoma granulations appear as small round bodies under the superficial layers of the conjunctiva. They are observed principally in the retrotarsal fold, but are often found all over the palpebral conjunctiva. Both forms are usually present as the disease progresses. As a rule there are few symptoms until the complications arise. After a long time, perhaps years, the hypertrophy

gradually disappears and is replaced by cicatricial tissue. There appear small areas or bands of whitened scar tissue in place of the reddened conjunctiva until the whole mucous membrane is transformed into a smooth shiny surface and the process is at an end. Unfortunately during the formation of the scar tissue complications arise and the eye is never free from danger thereafter. The first complication, which is caused by the contraction of the conjunctiva incident to the formation of the cicatrices, is entropion which causes the turning in of the cilia which feel and act like a foreign body in the eye, producing irritation and ulcers of the cornea. The shrinking, as it continues, will obliterate the fornices and the shrunken conjunctiva will be drawn into bands from the corneal edge to the lids (symblepharon). The conjunctival glands are also destroyed and the mucous membrane will be dry (xerosis conjunctivæ). The condition known as pannus, which is a formation of trachomatous tissue under the epithelium on the surface of the cornea, begins at the margin above and extends usually only to the horizontal line, sometimes terminating sharply and in a line of small ulcers. It appears as a thin vascular membrane. The vision is then seriously and permanently affected, for opacities remain if Bowman's membrane has been destroyed. Ulcers also occur independently of pannus and leave opacities.

Prophylaxis and Treatment.—Trachoma is only mildly contagious, but measures should be taken to prevent its spread in the family and especially in institutions. Towels, bed linen, etc., should not be used in common. Inspection of schools, institutions and immigrants is now helping to stamp out this disease. The treatment of an affection so recalcitrant is necessarily protracted and at times unsatisfactory. In order to reduce the hypertrophy of the conjunctiva it is necessary to apply active astringents such as sulphate of copper or nitrate of silver. The proper way to use the sulphate of copper is to turn the upper lid and rub the crystal across it two or three times. The stone should then be passed under the everted tarsus so as to reach the upper culdesac, which maneuver, though often omitted, is very important. The conjunctiva of the lower lid is treated in the same manner. The lids are then flushed with cold water. If sulphate of copper is used continually every day or two, most cases, if taken early, will be cured, although treatment must be persisted in for months or even years. Few patients, however, will continue faithful. Nitrate of silver undoubtedly will accomplish the same results, but the danger of argyrosis (permanent staining of the conjunctiva) precludes its use over long periods. One may begin with the nitrate of silver and pass to the sulphate of copper as the inflammatory signs subside. It is usually not very satisfactory for the patient himself to make use of these drugs or to be treated by a layman. Ointment of sulphate of copper (1 per cent) may be prescribed or a solution (1 per cent) in water and glycerin, but they deteriorate rapidly. Yellow oxid of mercury ointment (1 per

cent) is beneficial in the later stages. In the follicular stage before the trachoma granulations turn into cicatrices the best treatment is expression by Knapp's roller forceps followed for a time by applications of blue stone. The forceps consists of two corrugated rollers which squeeze out the contents of the granules like a wringer. Even in the later stages, granulations which remain should be expressed. During the later period and the last or cicatricial stage, an excision of the upper tarsal plate (operations of Heisrath and Kuhnt) often gives satisfaction. In severe cases of pannus a 3 to 5 per cent infusion of jequirity bean has been used two or three times a day (Fuchs) and the severe reaction which follows will clear the cornea. Entropion must be treated by operation. If ulcers appear one may continue treatment with nitrate of silver as well as sulphate of copper, although the latter is not thought advisable by some authors. Otherwise the ulcers are treated according to the principles laid down later under the appropriate heading.

Phlyctenular Conjunctivitis.—This is a disease of childhood in which one or more small red papules surrounded by an area of congestion appear under the bulbar conjunctiva usually at the limbus (marginal phlyctenule) and sometimes at a distance from the cornea. As the epithelium breaks down an ulcer is formed which later heals without leaving a trace. This eruption passes through its phases in a week or so but it is prone to repetition. The same lesion appears on the cornea and will be explained under that heading. Children subject to this affection are usually of the poorer classes, of the scrofulous or glandular type, badly nourished, with digestive disturbances, having adenoids, enlarged glands, rhinitis, otorrhea, and subject to eczema. It is thought to be an attenuated form of tuberculosis.

Treatment.—General treatment should be directed toward the improvement of the living conditions, especially diet. Sweets, tea and coffee are prohibited. Cod-liver oil, small doses of calomel (1/10 gr. three times a day) or rhubarb, iron and arsenic are useful. Tuberculin injections have also been employed with satisfactory results. Local treatment consists in the application of yellow oxid of mercury ointment (1 per cent) between the lids twice a day, rubbing it about with the lids closed. This, as well as other ointments, is best prescribed in collapsible tubes. Calomel powder may be dusted on to the eyeball and rubbed. If there is considerable irritation, as is often the case when the phlyctenules are on the corneal edge, it is well to instill atropin (0.5 per cent) three times a day. Under this treatment the ulcers will heal rapidly.

Spring Catarrh—Conjunctivitis Vernalis.—This is a very interesting disease, the cause of which is unknown. It is not happily named, as the attacks are not confined to the spring of the year and it is not a catarrh. It assumes two forms, the pericorneal and the tarsal. The former appears as slightly elevated yellowish patches at the limbus, sometimes completely

surrounding the cornea and encroaching a little on the corneal tissue. The tarsal form presents large flat cartilagelike granulations, usually with overhanging edges, inside the conjunctiva of the upper lid. They are sometimes confined to the ends of the tarsus. A characteristic sign is an appearance as if the eyelid had been washed over with milk. There is a scanty discharge which contains eosinophilic cells. Usually one of the two forms of the disease predominates. Patients suffer from irritation and photophobia during the hottest weather and are relieved in winter. It occurs in youth and lasts for a number of years with complete recovery.

Treatment.—There is no cure. The symptoms may be alleviated by adrenalin chlorid, 1:5,000, or by acetic acid, 5 gtt. to 10 gm. of water (Fuchs). Sunlight is thought by some to be prejudicial, especially the short wave-lengths at the end of the spectrum. Therefore the patient should wear colored lenses (Euphos or Crooke's) and they should keep out of the sunlight. It is impossible to express the granulations because they are very tough, but it helps to excise or cauterize them when redundant. Radium has been used with success.

Tuberculosis.—This occurs in the lid as an ulcer with a granulating base surrounded by an infiltration of tuberculous nodules. *Lupus* of the skin may also spread to the conjunctiva. It is rare.

Pterygium.—This is a fold of conjunctiva which extends on to the cornea in the form of a triangle. The apex (head) is pointed toward the center of the cornea. It probably originates in an inflammatory process starting at the pinguecula. It progresses slowly for a number of years but may at any time become very thin and stationary (pterygium tenue).

Treatment.—The pterygium should be sliced off the cornea and the head transplanted under the conjunctiva (see works on Ophthalmic Surgery). If simply excised it is apt to recur. As Bowman's membrane is involved, a slight opacity of the cornea results. After a burn or wound of the eyeball the conjunctiva is sometimes drawn on to the cornea in the healing process. This is known as false pterygium and differs from the true form in that sometimes a probe may be passed under the fold as well as by the fact that it does not progress. There is no other than surgical treatment available for this condition.

Symblepharon.—This is a condition in which the conjunctiva of the lid is adherent to the eyeball. It is the result of burns, wounds or trachoma.

Treatment.—When a probe can be passed underneath below the attachment of the band, treatment is simple since the adhesion may be separated and the bulbar conjunctiva stitched together. If the adhesion extends to the fornix, the same procedure may be successful; but, if large and the conjunctiva cannot be brought together, the wound must be closed by a graft of mucous membrane taken from the lip.

Xerosis.—This occurs in two forms: (1) The conjunctiva has been destroyed by some process, as trachoma, and becomes dry. There is no treatment. (2) This takes the form of white plaques which do not wet with the tears. They are readily scraped off like thick grease, leaving a bleeding surface, but they reform. This condition is found in patients having poor nutrition (lack of vitamins). They sometimes show hemeralopia (night-blindness). In poorly nourished infants it may assume a malignant form and spread over the cornea (keratomalacia). These children die of inanition.

Treatment.—The treatment should be devoted to the general health.

Ecchymosis.—Rupture of a blood-vessel under the bulbar conjunctiva is a common occurrence. It is due to traumatism, whooping-cough, or arteriosclerosis.

Treatment.—Ice-cold applications should be applied for a day or two to prevent further extravasation. These should be followed by fomentations to hasten resolution.

Tumors of the Conjunctiva.—These are rare. Among those found are dermoid, sarcoma, lypoma, cysts, papilloma.

Treatment.—They should be excised.

DISEASES OF THE CORNEA

Ulcer of the Cornea.—Ulcers are generally classified as simple and infected. The former, usually traumatic, tend to heal rapidly. They have a grayish base and show but little infiltration of the surrounding tissue. The infection, if present, is of the mildest type. They are usually small and circular in shape. The latter are due to the invasion of some pathogenic germ and are disposed to spread either superficially or into the depths of the cornea. They are accompanied by infiltration of the adjacent corneal tissue.

Examples of infected ulcers are:

Serpent ulcer of Saemisch (pneumococcus) which has a more or less circular form, yellow base and spreads by an advancing edge. It often causes an accumulation of leukocytes and fibrin, cast off from the iris and ciliary body into the lower part of anterior chamber (hypopyon).

Dendritic Ulcer.—These ulcers spread in branching lines over the surface of the cornea. They may be of malarial origin.

Rodent Ulcer (Mooren's).—This is a rare form, has overlapping edges and is difficult to control. It progresses slowly for months. The organism has never been isolated.

Marginal Ulcer.—These ulcers encircle the edge of the cornea.

Among the bacteria which are found in ulcers are the pneumococcus, staphylococcus, streptococcus, Morax-Axenfeld's bacillus ulceris corneæ,

Friedlander's bacillus mucosus, colon bacillus and the mould aspergillus. Patients with ulcers complain of pain, sensations of a foreign body and photophobia. There is a varying degree of circumcorneal congestion.

Treatment.—Ulcers should receive most careful attention because they leave opacities which interfere more or less with the vision, especially if they involve the center of the cornea. Simple ulcers yield readily to atropin (0.5 per cent) three times a day and a mild antiseptic. For infected ulcers the purpose of treatment is to cleanse the cornea and conjunctival sac, to destroy the microörganism, to allay irritation and to render the corneal tissue more resistant. In the first place, therefore, the eye must be flooded frequently with boric acid solution, bichlorid of mercury (1:10,000) or permanganate of potash (1:5,000). Secondly, some active germicide should be employed. Ointment of bichlorid of mercury (1:5,000), iodoform ointment (1 per cent) or iodoform powder dusted into the eye should be tried. If the ulcer shows a disposition to spread, more active agents should be employed. Tincture of iodin is exceedingly valuable for this purpose. The eye is cocainized and it is sometimes wise to curet the base of the ulcer, after which a small bit of cotton is wound on an applicator, dipped in the iodin and applied to the ulcer. This treatment should be repeated every day or two. Best of all, however, is the actual cautery. The electrocautery is often employed for this purpose but if a small probe is heated in the flame of an alcohol lamp and applied immediately it will cool rapidly, thus preventing too much destruction of the normal tissue. No more active or effective treatment can be recommended, but it must be remembered that some normal tissue will be destroyed if the cauterization is thoroughly done and it is quite possible, if the infection is not entirely destroyed and the resistance of the eye is low, that this procedure may serve only to encourage further necrosis. Carbolic, nitric or glacial acetic acids are employed by some, but their use is condemned because their action is difficult to control. Thirdly, to allay pain and irritation, as well as to improve the nutrition and prevent the involvement of the iris, it is necessary to prescribe atropin (0.5 per cent to 1 per cent) three times a day. This drug puts the iris at rest, relieves its congestion and acts as an anodyne. It should not be omitted as long as the eye is congested. Cocain (1 per cent) combined with adrenalin chlorid (1:5,000) is desirable for the comfort of the patient. Fomentations are also valuable and very grateful to the patient. They are applied as hot as they can be borne and the pads should never be allowed to remain over the eye when the heat has been dispelled. Bandaging of the eye is usually indicated unless there is a conjunctival discharge, in which case it is not wise to confine it. It is a common observation that when an ulcer perforates into the anterior chamber it immediately begins to heal because of the outward drainage. In the worst form of serpent ulcer, therefore, when the treatment has not arrested the process, a cataract knife may be

passed through its base, opening up the anterior chamber (Saemisch incision).

Phlyctenular Keratitis.—Phlyctenules appear on the cornea as well as on the conjunctiva. They cause great irritation and leave opacities, especially if they assume the fasicular variety where the phlyctenules form an advancing edge followed by a band of blood-vessels.

Treatment.—This is the same as for phlyctenular conjunctivitis except that atropin (0.5 per cent three times a day) must always be ordered.

Interstitial Keratitis, Parenchymatous Keratitis.—This disease begins either at the periphery or the center of the cornea and exhibits a diffuse opacity in the substantia propria caused by infiltration of leukocytes. When closely examined it will be found to vary in density. It slowly extends until, at times, the whole cornea is involved. During its course an area of dense vascularization may appear near the corneal edge (salmon patch). Involvement of the iris and ciliary body is a complication and glaucoma may ensue in bad cases. The process gradually subsides but leaves more or less opacity. Often in after years a careful scrutiny of the cornea with the ophthalmoscope will reveal fine threads which are the telltale remains of blood-vessels. The second eye is affected sooner or later. Interstitial keratitis occurs in children between the ages of five and fifteen, but it may appear in older patients. In many of the cases the cause is congenital syphilis, but it may appear in acquired syphilis as a secondary manifestation. It may also be due to tuberculosis and other causes. It runs a course varying from two months to a year. The patient complains of photophobia, some dimness of vision and sometimes pain. When due to congenital syphilis some of the characteristic signs are present frequently. The face presents a wizened appearance, the head is large with prominent frontals, there are cicatrices at the angles of the mouth and eyelids due to ulceration which did not heal readily because of the constant movement of these parts. The cervical and other glands are enlarged and deafness is often present. The teeth, especially the incisors, of the permanent set are peg-shaped (Hutchinson teeth) because of the non-development of the apex and show horizontal furrows as in rickets. The bridge of the nose is depressed.

Treatment.—Life in the open air and wholesome diet are probably the most effective measures in promoting the cure of this disease but are often slighted. Constitutional treatment in specific cases should be instituted, in spite of the fact that its effects are not always evident, for at times patients under intensive antisyphilitic treatment will develop lesions in the other eye. Children bear mercury well and it should be administered by mouth in the form of intramuscular injections or by inunctions. Arsphenamin may also be given. Tuberculous cases should receive tuberculin. The local treatment is exceedingly simple. It consists in the instillation of atropin (0.5 per cent) three times a day. The

drop should be continued as long as the process is active, but if the inflammation is severe and the iris congested its strength should be increased to 1 per cent and it should be used oftener. Fomentations are also of great value. In the later stages it is desirable to stimulate the process of resorption by yellow oxid of mercury ointment (1 per cent twice a day) introduced into the conjunctival sac and rubbed. Dionin (5 per cent) may also be prescribed. Colored glasses are worn when the light is bright.

Keratoconus (Conical Cornea).—This is an unusual condition of thinning and bulging of the cornea beginning in early life and gradually progressing until the cornea becomes conical with a rounded apex, which usually lies a little to one side of the center and shows a grayish opacity. The vision is seriously affected. There is no known cause.

Treatment.—In the early stages cylindrical lenses will improve the vision, but when it becomes worse the best treatment is to cauterize the apex of the cornea with the electrocautery, through its whole thickness. The contraction which follows the healing will tend to flatten the cornea. As an opacity remains at the site of the cauterization, it may be necessary to perform an optical iridectomy in order to bring the pupil over a clear area.

Injuries of the Cornea—*Foreign Bodies.*—Small particles such as cinders, dust, emery, etc., frequently lodge on the surface of the cornea. They produce great pain and irritation. If allowed to remain, they will be thrown off in time, leaving an ulcer.

Treatment.—All foreign bodies must be immediately removed. If they lie on the surface they may, at times, be brushed off by a bit of cotton on an applicator if the eye has been anesthetized. When imbedded, a small lance-shape needle (foreign body needle) rendered aseptic is employed to extract the foreign substance. The patient should recline in an operating chair and operator should stand behind. The eye must be well illuminated; best by concentrated artificial light. As little damage to the tissue as possible should be done. The physician should not lose his courage until all the particles have been removed, even if it is necessary to work deeply into the substance of the cornea. After the operation the eye should be bandaged and bichlorid of mercury ointment (1:5,000) prescribed.

Wounds of the Cornea.—Abrasion of the corneal epithelium is a common accident. The extent of the abrasion is best demonstrated by dropping fluorescein into the eye when the denuded area shows a livid green.

Treatment.—Effort is directed toward the prevention of infection. Argyrol (15 per cent), silvol (10 per cent), or bichlorid of mercury ointment (1:5,000) and atropin (0.5 per cent) are prescribed and the eye bandaged. If the patient complains of pain and irritation, cocain (1 per cent) in adrenalin chlorid (1:5,000) may be combined with the atropin. The abrasion often heals in a few hours but sometimes incompletely, leav-

ing an ulcerated area which must be treated accordingly. Deeper wounds of the cornea are of grave import and are often infected when first seen. Most serious are those which penetrate into the anterior chamber. In these cases the sudden outflow of the aqueous humor will carry the iris into the wound. Under these circumstances, if the patient is seen within three days and the wound is evidently not infected, the prolapsed iris should be seized by the small forceps and excised. The columns of the coloboma should then be carefully freed from the wound and replaced in the anterior chamber. If the case is seen later than this, it is better to leave it untouched since the iris cannot then be freed from the wound and the cut edges left in the wound serve as an entrance for infection. Large wounds of the cornea are sometimes covered by a sliding conjunctival flap under which they heal readily. If infection is feared or already present, the eye is treated with antiseptics and atropin.

Staphyloma.—A bulging of the cornea (as well as of the sclera) is called "staphyloma." It is caused by the weakening of the tissues incident to inflammatory or degenerative processes.

Treatment.—The only treatment is to abscise the staphyloma and suture the edges of the corneal wound. This operation is done in order to preserve the eyeball, for there is no hope for the vision if the whole cornea is involved.

DISEASES OF THE SCLERA

Inflammations of the sclera are divided into episcleritis and scleritis. The former affects only the superficial layers but the latter extends through the whole substance and often involves the cornea, ciliary body and choroid. A dividing line between the two is difficult to draw. Episcleritis occurs as a slightly elevated patch of congestion lying evidently beneath the conjunctiva, which is also congested. It is caused by syphilis or tuberculosis, but may appear in gouty or rheumatic patients. It is a chronic affection and liable to relapses. Scleritis presents more marked signs. The areas involved are usually large, the symptoms more acute. The patient often complains of pain and tenderness. The cornea is sometimes affected (sclerokeratitis) as well as the iris, ciliary body and choroid (anterior uveitis). The thinning of the sclera weakens it and leads to staphyloma or at least leaves a dark patch over the site of the lesion. Glaucoma sometimes complicates the case. The causes are the same as for episcleritis.

Treatment.—The essential question to decide is the underlying cause. Antisyphilitic treatment may be indicated or tuberculin injections when the tests are positive. If these causes cannot be assigned, a thorough search should be made for some focus of infection, as, for example, in the teeth,

tonsils, sinuses, or for intestinal absorption. Sodium salicylate, aspirin, tolysin, or iodid of potash may be given. The eye is treated with atropin, especially if the cornea or iris is involved, and with fomentations.

Injuries to the Sclera—*Treatment.*—Perforating wounds, if small and clean, will generally heal under a bandage, bichlorid of mercury ointment (1 : 5,000) being introduced into the conjunctival sac. Large wounds, which gape with the vitreous presenting, if not infected, will often do surprisingly well if the edges are carefully brought together with fine silk sutures. In many cases it is sufficient to suture the conjunctiva over the wound.

Perforating wounds of the cornea and sclera may be followed by a purulent inflammation of the whole interior of the eye (panophthalmitis). The conjunctiva is deeply congested, chemotic, and there is exophthalmos. A yellow reflex is seen back of the lens or pus may be found in the anterior chamber. The lids are red and swollen and the patient usually suffers much pain.

Such eyes should be removed as soon as the diagnosis is established. When the process is well advanced, some surgeons hesitate to enucleate because they fear meningitis. It is perhaps safer to make an incision into the eyeball to allow drainage and thus relieve the pain, delaying the enucleation until the active signs have disappeared.

Rupture of the Eyeball.—Rupture of the eyeball from a blow generally takes place near the margin of the cornea and may be associated with other lesions, such as intra-ocular hemorrhage, detachment of the retina, tearing of the iris, or dislocation of the lens.

Treatment.—If it is thought that the eye can be saved, the wound should be stitched together. If there has been much loss of vitreous, or hemorrhages with no prospect of regaining the sight, the eye should be enucleated at once. This is done because these eyes pass into a state of iridocyclitis and shrink, becoming a danger to the other eye (sympathetic ophthalmia).

Enucleation.—In performing enucleation the conjunctiva is cut with the scissors all about the cornea and dissected well back on the eyeball. Tenon's capsule is then opened and the scissors passed under it well back on all sides. The muscles in turn, including the obliques, are caught on a strabismus hook and severed at their attachment. A large pair of scissors, curved on the flat, is passed on the nasal side to the posterior pole and the optic nerve is cut. The eyeball will then protrude and the adhesions can be released. A purse-string suture, which will pass through the cut edge of both Tenon's capsule and the conjunctiva, closes the wound. A piece of fat taken from the hip, or a gold ball, may be inserted into Tenon's capsule and form a stump. This is done in order that the artificial eye may not sink into the orbit and that it may have a certain amount of movement.

Foreign Body within the Eyeball.—At this point it may be well to discuss those cases in which a foreign body has entered and is retained in the eyeball. The substances which enter are usually metal, steel or brass, because bodies of less specific gravity impinging upon the resisting coats of the eye do not have sufficient momentum to penetrate. The most common accident occurs when a chip of steel flies from a hammer or chisel. It is only in very rare cases that an eye harboring a foreign body retains useful vision. Every effort should therefore be exerted to remove it.

Treatment.—The history of these cases should be carefully taken and the eye inspected for the wound of entrance, which is sometimes very small, in the sclera or cornea. If the foreign body has entered through the cornea there may be a hole in the iris or a cataractous lens. An X-ray photograph is then taken to determine if a foreign body is present and to localize it if possible. There is little chance of removing any foreign body but steel, but this is often successfully done by means of the large electromagnet. The steel is withdrawn around the lens into the anterior chamber and extracted through a small incision in the cornea or it may be removed through an opening made in the sclera. An eye containing a foreign body usually develops a chronic iridocyclitis and, if the fragment is steel, will show a reddish-brown discoloration of the iris (siderosis). Sometimes a small particle will become encysted in the vitreous; the vision, however, is eventually lost.

DISEASES OF THE IRIS

Iritis.—This disease shows a discoloration of the iris which loses its fine markings and has a blurred or muddy appearance. The pupil is small and irregular. The pupillary edge of the iris is attached at points to the anterior capsule of the lens (posterior synechiæ). The anterior chamber may be cloudy and there may be a punctate deposit on Descemet's membrane (Descemetitis). A mass of gray exudate is sometimes found on the iris (spongy iritis) or blood (hyphemia) or pus (hypopyon). There is a well-marked circumcorneal congestion. The patient complains of dimness of vision, photophobia and pain which is worse in the early hours of the morning. When the eyeball is tender to touch, it usually denotes involvement of the ciliary body. Acute iritis usually lasts for about a week or more. Most cases, if taken early, recover completely except perhaps for a few small spots on the anterior capsule where the synechiæ have started to form. If neglected, the iris may become attached all about at its pupillary edge (exclusion), and glaucoma ensues because of the interference with the normal intra-ocular circulation. The iris then bulges from its pupillary edge (iris bombé). Iritis may also assume the chronic

form. An important variety is the so-called recurrent iritis. Attacks are usually mild, showing slight congestion and a few other signs, but synechiæ form with each attack and the pupil is finally closed with exudate, the iris being completely attached to the lens. An enumeration of the causes would include syphilis, tuberculosis, rheumatism, gout, gonorrhea, and toxemia originating in focal infections. In this connection it would be well to speak of the diseases of the ciliary body, since the etiology and treatment are the same as of iritis. Furthermore, the iris and ciliary bodies are often both involved at the same time, such a condition being known as iridocyclitis. The signs by which we recognize cyclitis are tenderness over the ciliary region elicited by pressure on the upper lid, deposits on Descemet's membrane, opacities in the vitreous and variation in the intra-ocular pressure. The symptoms are also usually more pronounced than those of simple iritis. There may be mentioned also a milder form of inflammation known as serous iritis which involves the whole uveal tract—iris, ciliary body and choroid—and shows moderate congestion. Descemetitis is also present, and a deep anterior chamber, dilated pupil, opacities in the vitreous and plus followed by minus tension.

Treatment.—The teeth, tonsils and accessory sinuses must be thoroughly inspected and given proper treatment as they are a fruitful source of trouble. It is possible that auto-intoxication may play a part. Any constitutional disease must be energetically treated. In lieu of more specific remedies, sodium salicylate in large doses or iodid of potash may be given. At the beginning of the attack a purgative should be administered. Local treatment is exceedingly important, atropin being the remedy par excellence. It should be prescribed at intervals which depend on the severity of the attack and the readiness with which the pupil dilates. Usually during an acute attack a 1 per cent solution is instilled every two or three hours. Compresses taken from boiling water are necessary. Anodynes may be prescribed if the pain is severe.

Sympathetic Ophthalmia.—The possible occurrence of this disease should never be absent from the mind of the physician when dealing with traumatic injuries of the eye. Its onset, sometimes sudden, sometimes insidious, spells blindness for life which can be avoided if the dangers are recognized. A typical case is as follows: The eye has received a perforating wound in the zone half an inch surrounding the cornea (ciliary region). It passes into a state of chronic iridocyclitis, that is to say, it is congested, painful, tender over the ciliary region, shows deposits on Descemet's membrane, a muddy iris and exudate in pupillary area with nearly total loss of vision. The process continues for an indefinite period, varying in intensity. The eye finally begins to shrink in size. At any time after two weeks, though generally not before six weeks, the other eye becomes slightly congested with a few deposits on Descemet's membrane, slight discoloration of the iris, small pupil, loss of accommodative power

and dimness of vision. In the great majority of cases, under these conditions, the second eye gradually goes to ruin in spite of the most active treatment. Variations from the typical case occur. The original wound may be in some other part of the eye than the danger zone, or the process in the sympathizing eye may begin as an optic neuritis, or the disease in the second eye may be delayed even years after the original injury. What is known as sympathetic irritation occurs in some instances, the second eye showing subjective symptoms only—irritation, photophobia and lacrimation. This condition should be differentiated from the true sympathetic ophthalmia, as no actual lesions appear, but it should serve as a warning because it may be the forerunner of the actual disease. No entirely satisfactory explanation of the way in which the infection is transferred has as yet been suggested. It has been thought that it passed through the optic nerve and chiasm (Deutschmann), or through the vaginal spaces in the optic nerve sheath. It has been suggested also that the disease is produced by irritation of the ciliary nerves (Mueller). Another theory is that a toxin having a selective action for the uveal tissue is transferred through the general blood current. At present ophthalmologists are inclined to regard the disease an an anaphylactic phenomenon (Elschnig). That it is an infection is highly probable from the fact that it never occurs, except in very rare and questionable cases, unless the injured eyeball has been perforated.

Treatment.—Every physician should know that an eye which has been injured and is in a state of iridocyclitis is a menace to the other and should be enucleated. Even cases in which the injured eye shows no evidence of active inflammation are a potential danger, for the process in the injured eye may light up again at any time. Such patients should be warned of the danger and told to report at once if the injured eye should become red. A decision as to whether enucleation is advisable is sometimes difficult to arrive at, for the wholesale removal of injured eyes is certainly to be condemned. It is the part of wisdom for the general practitioner to consult an ophthalmologist if he has a doubt as to the proper course to pursue. If sympathetic ophthalmia has appeared, it is yet quite possible that the eye may be saved by appropriate treatment. The pupil must be kept well dilated with atropin, hot compresses applied and the patient given mercury in full doses. Large doses of sodium salicylate are also recommended.

GLAUCOMA

An eye with intra-ocular tension above normal has glaucoma and the normal tension does not vary much from 25 mm. of mercury. Glaucoma is described as primary, in which case there has been no antecedent disease to which the pressure can be attributed, or secondary, where the ten-

sion is a complication of some other condition, as, for example, closure of the pupil. The etiology of primary glaucoma is a complex problem. It depends upon the disturbed relation between the inflow and outflow of the lymph. There may be excessive secretion (von Graefe, Donders) or obstruction in excretion through the iris angle and venæ vorticosæ (Priestly Smith) caused by senile sclerosis, which narrows the passages and destroys the elasticity of the tissues. Primary glaucoma is subdivided into inflammatory, acute and chronic, and non-inflammatory.

Acute Inflammatory Glaucoma.—This disease is usually preceded by prodromal symptoms such as attacks of blurred vision, halos about the lights and perhaps slight congestion of the eyeball. The onset is sudden and apt to occur after the patient, who is so disposed, has been under a mental or physical strain. The eye becomes deeply congested and very hard, the pupil is enlarged and elongated in the vertical meridian, giving a dull green reflex. The cornea is hazy from edema, the anterior chamber shallow, and the vision sinks to a low level in a few hours. The patient suffers from neuralgic pain in the distribution of the fifth nerve and may develop constitutional signs with vomiting. For these latter reasons he often consults his family physician, not attributing his sufferings to the eye. Acute glaucoma is often confused with acute iritis, but the physician will not fall into this fatal error if he observes the signs with great care.

Treatment.—A patient with acute glaucoma should be put in bed and given sufficient morphin to relieve the pain. A cathartic should also be administered. Pilocarpin (1 per cent) and eserin (⅓ per cent) are instilled every hour or two alternately and hot compresses applied. Leeches to the temple may also give relief. In some cases the attack may be treated successfully in this manner, but, if the symptoms show no signs of abatement in twenty-four hours or so, the patient should be given a general anesthetic and an iridectomy performed. A lance knife is introduced above just back of the corneal margin and passed into the anterior chamber, taking care not to injure either the lens or posterior surface of the cornea. This is not easy, because there is very little space between them. If the iris does not present in the wound, the iris forceps must be introduced, the iris drawn out and cut off. The columns of the coloboma are then replaced. This operation is very difficult to perform and must not be undertaken by the general surgeon.

Chronic Inflammatory Glaucoma.—After one or more attacks of acute glaucoma, an eye may not completely recover but pass into a state of chronic inflammatory glaucoma; the symptoms are similar to those of the acute form but less intense. An eye in this condition can rarely be controlled with miotics and there is little chance of regaining useful vision. Either an iridectomy or trephine operation (Elliot) is indicated in most cases for the relief of pain. Trephining is performed by dissecting a flap

of conjunctiva above the corneal edge down on to the cornea and cutting out, with the trephine, a small disk which will include part of the sclera and part of the cornea. The iris will present and is excised. The flap is then replaced covering the opening. Direct drainage into the subconjunctival spaces is thus accomplished. The Lagrange operation is preferred by some. An incision is made above the corneal margin and a crescent-shaped piece of the sclera is excised from the lower edge of the wound, thus leaving an elongated horizontal opening. Sometimes a puncture into the anterior chamber well back into the sclera (anterior sclerotomy) will relieve the symptoms, especially if repeated, or it may be made further back in the sclera entering the vitreous chamber (posterior sclerotomy). Many times such an eye will quiet down and become comparatively comfortable, but it is still hard, has a dilated pupil, cataractous lens, opaque cornea and is totally blind (absolute glaucoma). When the suffering of the patient has been long continued without relief, enucleation is the only remedy.

Non-inflammatory Glaucoma (Glaucoma Simplex).—This disease is characterized by an insidious onset and is easily overlooked. The patient complains of halos about artificial lights, contracted field of vision and generally of blurred sight. The eye usually shows no outward signs but the intra-ocular tension, best taken with the tonometer, is found more or less elevated. The optic nerve is pale and cupped or punched out from the internal pressure since this is the weakest part of the globe. The field will be found contracted especially on the nasal side. The central vision may not be affected even though the field has contracted to narrow limits (telescopic vision). Only later in its course is there pain or congestion. The process continues until the sight is entirely gone and the eye passes into a state of absolute glaucoma. This disease affects both eyes.

Treatment.—Physicians should realize that eyes with increased pressure are on the road to ruin. Unfortunately the actual cure of glaucoma is impossible. The best that can be done is to establish artificial drainage. However, some cases of glaucoma simplex may be held in check for many years with treatment by miotics. It is customary, therefore, to begin with pilocarpin (1 per cent) three times a day, and if the tension drops to normal more radical measures may be postponed, yet the patient is never safe and frequent examinations should be made. If the tension is not lowered or returns it is necessary to perform some operation to rescue the eye from inevitable blindness. Iridectomy, so performed that a broad base is cut from the ciliary body, has stood the test of time and will in many cases arrest the disease for years, but one must not expect any improvement in the field of vision. The worst cases are those in which the field has contracted to near the fixation point. Trephining is also successful in many cases, more especially those with narrow fields. Cases

of secondary infection after this operation have been reported because the thin layer of the conjunctiva offers entrance to germs.

Secondary Glaucoma.—This complication may appear from many different causes. There may be mentioned iridocyclitis, prolapsed iris, dislocation of the lens, swelling of the lens, intra-ocular tumors, exudate in the anterior chamber and arteriosclerosis.

Treatment.—Treatment is according to the principles laid down above and varies with the individual case.

Congenital Glaucoma (Buphthalmos).—A peculiar disease of early childhood characterized by increased tension and enlargement of the whole eyeball with the sclera and cornea thinned.

Treatment.—Treatment is unsatisfactory, although iridectomy or trephining have been tried.

DISEASES OF THE LENS

Cataract.—A cataract is an opacity of the crystalline lens or its capsule. The common forms are senile, traumatic, congenital, polar and complicated.

Senile cataract occurs after middle life, beginning usually with either radiating striæ of opacity in the cortex or as a diffuse cloud in the center or nucleus. The opacity increases until the whole lens is involved. The course of the process is slow, extending sometimes over many years. The patient complains only of failing vision and the physician sees the opacity with the ophthalmoscope or oblique illumination. Before the opacity is complete the lens usually passes through a state of swelling which later recedes. Sometimes, if the swelling of the lens occurs before the opacity is very dense, the patient will read without glasses at the near point. This is because the lens has become more convex. It has been called "second sight." Cataracts remain in the mature state for a number of years, but the cortex may gradually become fluid while the nucleus, which is harder, sinks into the lower part (Morgagnian cataract).

Traumatic cataract develops either from a contusion of the eyeball or as the result of a wound of the capsule. Development is usually quite rapid, especially if the opening in the capsule is large. As the lens absorbs the fluid, it swells so that it may block the iris angle and produce glaucoma, which is evidenced by congestion of the eyeball, pain and increased tension. When the capsule has been widely opened, the swollen lens fibers may gradually dissolve and the pupil become clear.

Congenital cataract is usually lamellar or zonular, showing an opaque zone surrounding the nucleus and leaving a clear cortex. It remains stationary through life but sometimes becomes complete.

Polar cataract is a circumscribed opacity at the anterior or posterior pole of the lens. It usually produces little disturbance of vision.

Complicated cataract occurs in connection with various forms of intraocular inflammation and degeneration, such as iridocyclitis, choroiditis, and absolute glaucoma.

Treatment.—It is impossible to affect the progress of senile cataracts by any local or constitutional treatment. They must be extracted. The most favorable time to operate is when the cataract has reached the stage of maturity. As this is often long delayed and as both eyes may be equally involved, the patient is obliged to wait for a number of years in a state of semiblindness. Under these circumstances it is often possible to hasten the ripening of the cataract by making a small iridectomy and by gently stroking the anterior surface of the lens with a small spatula. Some operators do not hesitate to extract an immature cataract although it is more difficult to remove all the cortical matter, which is apt to produce irritation if left in the anterior chamber. Another method of dealing with the immature cataract is to extract it with its capsule (operation of Colonel Smith). This operation was developed in India, but is not thought applicable to patients in this country because of its difficulties, dangers and higher standards of vision which are demanded.

The physician may determine whether the cataract is mature and suitable for operation by observing the following points: The tension of the eye is normal and the cornea free from opacities. The pupil reacts quickly to light and the iris is not discolored or attached to the lens capsule. The lens is of grayish white appearance and the opacity involves it completely so that there is no shadow cast by the pupillary edge, on the side toward the light, when it is thrown in by oblique illumination. When light from the ophthalmoscopic mirror is reflected into the eye from all sides, it is accurately located, thus determining the integrity of the retina. An examination of the lacrimal sac should not be forgotten, for no operation is permissible in the presence of infection. It is wise also to take a smear and culture from the conjunctival sac.

The operation for cataract extraction requires special skill and experience and should not be attempted by the general surgeon. Only the simplest outline of the various steps of the operation can be given here. The eye is anesthetized with cocain or holocain and the conjunctival sac thoroughly irrigated. An incision is made upwards at the corneal edge with a cataract (Graefe) knife involving nearly one-half of the circumference. A piece of the iris is then drawn out and excised (iridectomy). A sharp-pointed cystotome scratches open the anterior capsule (capsulotomy) or a piece of the anterior capsule may be extracted with a capsule forceps. Pressure is then applied at the lower corneal edge and toward the center of the eyeball so the cataract will be forced out through the incision. The iris is carefully replaced and a light dressing applied.

Dressings are changed every day and the patient may leave the hospital in about two weeks. If no iridectomy is done, the operation is called the "simple extraction." The danger of prolapse of the iris during the first few days renders this operation less desirable. Sometimes the capsule of the lens may later become wrinkled or opaque (secondary cataract) and may be dealt with by cutting it with a small knife needle (discission). As stated above a *traumatic cataract* may dissolve spontaneously if the opening in the capsule is large enough. If all or part of the lens should remain, its absorption may be brought about by opening the capsule with a knife needle so as to allow the aqueous humor to permeate the lens substance. The only danger, aside from infection, is the too rapid swelling of the lens, which will produce a secondary glaucoma. In this case the lens matter should be evacuated through a corneal incision. If large enough to cover the pupillary area and seriously affect the vision congenital cataracts must be treated by discission. The operation may have to be repeated if the absorption is stopped by the closing of the incision. It may be said, in general, that discission is the operation of choice in all forms of cataracts in patients under twenty-five years of age; extraction if the patient is older. If the cortex is sufficiently clear, an iridectomy will sometimes allow satisfactory vision by creating an artificial pupil to one side of the opacity. *Polar cataracts* usually need no treatment. *Complicated cataracts* are treated by discission or extraction if the promise of the recovery of vision seems to be sufficiently good.

Dislocation of the Lens.—The lens is occasionally either wholly (luxation) or partly (subluxation) torn from its attachment to the ciliary body and displaced into the vitreous or even through the pupil into the anterior chamber. In the former position, it is liable to provoke reaction of a serious nature; in the latter, glaucoma. Except for the congenital cases the cause of dislocation of the lens is traumatic.

Treatment.—A dislocated lens may remain innocuous, but if it is producing trouble it must be removed from the vitreous chamber, if possible, with a wire loop through a cataract incision or by expression from the anterior chamber through a cataract incision.

DISTURBANCE OF MOTILITY

Six muscles in each eye serve to move it in all directions. If these forces are properly distributed they are said to be in balance. Weakness, paralysis, or spasms of one or more of these muscles destroy the balance. A classification of the disturbances of balance is: insufficiency, strabismus and paralysis.

Insufficiency.—Insufficiency, sometimes called heterophoria, is a tendency for the eyes to deviate from the object of fixation, which tendency,

however, never results in actual deviation. It is latent. The patient keeps the eyes straight but with an effort. A simple way to determine whether the eyes are in balance is to cover one with a card and note whether it makes the slightest movement on being thus deprived of an object of fixation. It naturally deviates in a direction away from the weak muscle. Another test is performed with a prism, which, if placed with its base down over one eye, will throw the image of a small light upward. The two eyes thus disassociated will deviate if there is lack of balance and the upper image will not be directly over the under as it should be.

The dynamic power of each set of muscles may be measured also by determining the strongest prism through which the images can be fused. In this test the apex of the prism is placed over the muscle whose action is called into play. Normally the external recti should fuse images through a 7° or 8° prism, the internal recti through a 20° prism or more. Weakness of the external recti is called esophoria; of the internal recti, exophoria; and of the elevators or depressors, hyperphoria.

Treatment.—Slight errors usually need no attention and even the more marked errors sometimes produce no trouble. The first thing which should be done is to correct any error of refraction. If the symptoms are not relieved, a weak prism may be ordered to be worn as an eyeglass, the base placed over the weak muscle. This procedure, however, does not tend to strengthen the weak muscle; on the contrary it is justified only for the alleviation of symptoms. Another method of treatment is to exercise once or twice a day the set of weak muscles by fusing the double images produced by a prism placed with the apex over the defective muscle. In marked cases, that is, those with a fusion power about 12° for the external recti or those showing a decided tendency to converge the eye when looking at a distance, a tenotomy of the external rectus or internal rectus respectively may be performed. Operations on ocular muscles, however, should only be done after an exhaustive study of the case and only by one of experience.

Strabismus.—This is a condition in which one eye only is directed toward the object of fixation, the other deviating either to the right or left (very rarely upwards). In convergent (internal) strabismus the lines of sight cross. In divergent (external) strabismus they diverge.

We shall deal first with the form called *concomitant* strabismus because it is unchanged in whatever direction the eyes are turned. This is not true of paralytic strabismus.

Convergent strabismus appears between the age of one to three years and is first noticed, for short periods, when the child is tired or excited. The interval between its appearance gradually decreases and in most cases it becomes permanent. The eye which squints commonly has defective vision (amblyopia) and a higher refractive error than the other. The amblyopia is probably usually congenital, although the fact that the

image is suppressed to avoid diplopia may be the cause (*amblyopia ex anopsia*). Hypermetropia is a constant accompaniment of convergent strabismus and is the underlying cause, because excessive accommodation which must be exerted to correct the refractive error leads to excessive convergence since the two functions are closely correlated.

Treatment.—There is a general impression that nothing can be done for strabismus until the child is old enough to be operated upon. This is untrue. The fusion sense is acquired at an early age and every effort should be made to preserve it or prevent its loss. At the first sign of turning of the eye, the refractive error should be corrected with glasses, if the child is old enough to wear them. The assistance thus given to the accommodation will often be sufficient to correct the tendency to squint. It is wise also to instill a drop of atropin in the *straight* eye every day for short periods. The blurred vision produced by the paralysis of the accommodation will force the child to use the other or squinting eye. This treatment is repeated at intervals. Another method of accomplishing the same thing is to place a blinder over the straight eye, if the child will tolerate it. In order to develop and preserve the fusion sense, exercise with a stereoscope, especially adapted to this purpose (Worth's amblyoscope) is recommended if the patience of the child and his parents is sufficiently enduring. If the condition has reached a stage where improvement is not to be expected by these methods, operation is indicated. Most surgeons prefer to wait until the child is at least seven years of age because, by that time, the operation may be performed under a local anesthetic, which is desirable, and because the results are more likely to continue permanent.

If the motility of the squinting eye is increased inwards so that it sinks into the internal canthus, a tenotomy of the internal rectus is indicated. If the motility outward does not carry the eye to the outer canthus an advancement of the external rectus is generally necessary. The effect of a full tenotomy depends upon the relation between these two movements. If the straight eye also shows marked increased motility inwards it may be necessary to tenotomize its internal rectus. Great care and study should be given these cases since an overeffect is deplorable.

Tenotomy of one of the recti muscles is not a difficult operation. The conjunctiva is opened over the attachment of the tendon and then an opening is made through Tenon's capsule, which covers the tendon as well as the eyeball. Failure to perform this step of the operation properly is a common fault of the novice. A strabismus hook is then inserted under the tendon and it is severed from its attachment with the scissors. Outlying fibers must be searched for with the hook and cut. Too much dissection of Tenon's capsule backwards may result in a shrunken caruncle and an overeffect. A vertical suture should then be placed to close the wound in the conjunctiva.

Advancement is performed by inserting sutures well back in the tendons and then passing them through the superficial layers of the sclera near the cornea. A piece of the tendon may be cut off in front of the sutures or the muscle may be folded on itself.

Divergent Strabismus.—This defect occurs as an accompaniment of myopia and also when an eye, for any reason, has lost its useful vision. This deformity is more striking than that of convergence strabismus.

Treatment.—Myopic cases should wear glasses which fully correct the refractive error. In cases with defective vision which cannot be corrected, a tenotomy of the external rectus and an advancement of the internal rectus are necessary to correct the strabismus. Tenotomy alone is seldom sufficient except in the least marked cases.

Paralysis.—Paralysis or paresis may affect one or more of the ocular muscles. The most obvious sign is a limitation of motility in the direction in which the paralyzed muscle should act, but this may be difficult to elicit if the paralysis is not complete. There will be present also in some part of the field of fixation a strabismus. This varies according to the direction in which the eyes are turned, disappearing when they are turned away from the paralyzed muscle. The patient complains of diplopia and, to avoid it, will turn his head toward the side of the paralyzed muscle. He sometimes suffers from dizziness, nausea and confusion of vision. A study of the images will assist in determining which muscles are affected and the following rule may prove useful: The image of the paralyzed eye seems to the patient to occupy a position, relative to the other image, which represents the physiological action of the muscle paralyzed. For example, a paralysis of the right external rectus gives a diplopia with the image belonging to the right eye to the right and on a level with the other. The distance between the two images increases as an attempt is made to turn the eyes to the right. It may be said here, however, that in old cases secondary contractions often obscure the signs.

The action of each muscle is here given:

External rectus turns eye out.

Internal rectus turns eye in.

Superior rectus turns eye up, in and rotates the upper end of the vertical meridian in.

Inferior rectus turns eye down, in and rotates the upper end of the vertical meridian out.

Superior oblique turns eye down, out and rotates the upper end of the vertical meridian in.

Inferior oblique turns eye up, out and rotates the upper end of the vertical meridian out.

The causes of ocular paralysis are syphilis, traumatism, diphtheria, locomotor ataxia, influenza, lethargic encephalitis, botulism, brain tumor, meningitis, lesions in the orbit; in fact any toxic, inflammatory, degen-

erative or mechanical agent which may affect the cerebral nerves. The physician will find profit in reviewing his anatomy of the cerebral nerves supplying the eye as an aid to the diagnosis of cerebral lesions.

Treatment.—This is directed toward the cause. Aside from cases due to brain lesion or traumatism, the majority are syphilitic and should be treated accordingly. When the cause is not established it is well to give iodid of potash, perhaps mercury, or large doses of sodium salicylate. Strychnin is indicated in diphtheritic and many other cases. Massage, electricity, and prism exercises are of little value. In incurable cases the patient may be obliged to resort to a cover or ground glass over the affected eye. Operations usually give unsatisfactory results except for the cosmetic effect.

DISEASES OF THE RETINA

The affections of the retina which will most likely come under the observation of the general practitioner are albuminuric, diabetic, or syphilitic retinitis; arteriosclerosis, embolism, and thrombosis. These are all dependent upon or associated with some disturbance in other parts of the body. Retinitis pigmentosa, detachment and tumors are also to be mentioned. As in general the treatment of the diseases of the retina is directed toward some constitutional cause, these affections will not be described at length.

Albuminuric Retinitis.—Chronic interstitial nephritis is the most common cause of retinal changes but they may occur also in chronic parenchymatous nephritis, as well as in the nephritis of the acute infectious diseases and the nephritis of pregnancy. Both eyes are involved. The three most characteristic signs are congestion and edema of the optic nerve and retina, shining white patches scattered over the fundus and a star-shaped figure made by radiating glistening white lines arranged about the macula. The blood-vessels are distended, and flamelike hemorrhages occur. The vision is more or less affected. In cases of this character the prognosis for life is decidedly bad except in pregnancy and infectious diseases. Occasionally a nephritic patient will suffer from attacks of blindness associated with other uremic symptoms with no changes found in the retina.

Treatment.—There is no local treatment of the slightest value. If albuminuria and retinitis occur early in the course of pregnancy, it is justifiable to induce abortion in order to save the vision if for no other reason. When nephritis appears later with retinitis as a complication the induction of premature labor may be indicated.

Diabetic Retinitis.—This condition shows scattered white patches and spots with retinal hemorrhages. The optic nerve is usually not involved.

The *treatment* is for the general disease (see Volume IV, Chapter 22).

Syphilitic Retinitis.—Retinitis may occur in the second stage of acquired syphilis as well as in the congenital form. The most characteristic signs are congestion of the disk and retina, the fundus having a hazy appearance partly due to the dustlike opacities in the vitreous. Grayish white and pigmented spots are found with white lines of exudate along the blood-vessels.

The *treatment* is that of syphilis (see Volume III, Chapter 31).

Arteriosclerosis.—The blood-vessels of the retina often show characteristic signs of arteriosclerosis and high blood-pressure. The veins are distended, the arteries in crossing the veins dent them, causing a slight distention of the vein on the distal side and the arteries appear outlined by thin white lines (perivasculitis). The outline of the optic disk is blurred and the small vessels about the nerve are tortuous. Arteriosclerosis of the retinal vessels is usually an index of the condition of the vessels throughout the body, but more especially in the brain.

Treatment.—Every effort should be made to keep down the blood-pressure and arrest the progress of the sclerosis (see Volume V, Chapter 16).

Embolism of the Central Artery of the Retina.—Occasionally a small particle free in the circulation will lodge in the retinal artery as it forks at the optic nerve. The blood is entirely cut off from the retina and the patient suddenly becomes totally blind in the affected eye. The retina in a short time becomes edematous, of a grayish appearance and the arteries are practically obliterated. There will be a bright cherry red spot at the macula because of the absence of edema at this spot. The central vision is sometimes retained because the macula region is, in a certain proportion of cases, supplied by a blood-vessel from the ciliary arteries. If the circulation is not reëstablished the retina will degenerate and atrophy and blindness will be permanent. Sometimes an embolus will lodge in one of the branches of the artery, in which case the blindness and atrophy are confined to the area cut off. Thrombosis of the retinal arteries occurs, giving the same signs. Thrombosis of the veins shows venous distension and multiple hemorrhages.

Treatment.—If a case is seen early it may be possible to dislodge the embolus and allow it to pass into one of the smaller branches. To accomplish this purpose nitrate of amyl should be inhaled and the eyeball massaged. Puncture of the eyeball to relieve the tension is justifiable. There is no local treatment for thrombosis.[1]

[1] The occurrence of embolism of the central artery of the retina demands a complete physical examination with an attempt to determine the source of the embolus.—Editor.

Retinitis Pigmentosa.—This disease is characterized by slowly progressing degeneration of the retina and deposits of retinal pigment beginning at the periphery. The pigment is formed along the vessels and assumes the so-called bone-corpuscle form having branching processes. The nerve is pale and the arteries small. The patient complains of poor vision especially at night (night-blindness) and of contraction of the field of vision. There is a strong hereditary influence and occasionally the patients are children of consanguineous marriage.

Detachment of the Retina.—The retina becomes detached from the underlying choroid. With the ophthalmoscope it shows as a grayish protuberance in the vitreous with the nearly black retinal vessels running over it. The field of vision is lost over the corresponding area. The usual causes are traumatism and high myopia, although blood exudate or a tumor mass may separate the retina from its attachment; so also will bands of connective tissue forming in the vitreous.

Treatment.—If seen early it is considered necessary to put the patient in bed for a month or two and to administer pilocarpin sweats. The eye should be kept under atropin (0.5 per cent) once a day and subconjunctival injections of normal salt solution given every two or three days. Puncture or trephining of the sclera has been recommended. A few cases of spontaneous recovery have been reported, but in general the prognosis is exceedingly poor, for in the end the retina is likely to become totally detached.

Glioma of the Retina.[2]—This malignant tumor occurs in children under five years of age. It appears as a white or yellowish mass in the vitreous with small vessels running over it. The tumor grows until it ruptures the eyeball and protrudes from the orbit. The child dies of exhaustion or from involvement of the brain. Sometimes both eyes are affected. The diagnosis is at times rather difficult, since a metastatic choroiditis resembles glioma. In the former case, however, the pupil is usually contracted and bound down by synechiæ and the exudate in the vitreous shows no vessel formation. An important diagnostic sign in metastatic choroiditis is the retraction of the ciliary body and the deepening of the anterior chamber at the periphery, while the inner zone of the iris and the pupil are pushed forward. These appearances are due to the formation of connective tissue from the ciliary body across the back of the lens.

Treatment.—An eye containing a glioma should be enucleated at the earliest opportunity. In a small percentage of cases the child's life may be saved. If the tumor has broken through the eyball involving the orbit, exenteration of the orbit may be indicated, although such a measure is only of temporary value.

[2] Although this tumor is not a true glioma, no term has yet been suggested which has won universal acceptance.

DISEASES OF THE CHOROID

Choroiditis.—This disease appears as ill-defined patches of nearly white exudate which usually involve the retina and obscure it. These patches vary in number and size. Opacities of the vitreous are also often present and there are defects in the field of vision. After a month or more the exudate disappears and leaves a white patch around which is more or less pigment. The choroid is atrophied and the sclera shows through. Choroiditis is generally due to tuberculosis, syphilis or systemic infection. Except in cases appearing in the last stages of tuberculous meningitis, the lesion is rarely associated with active manifestations in other parts of the body.

Treatment.—The constitutional treatment is that of syphilis or, if tuberculous, tuberculin injections. Local treatment is of no value except when the anterior part of the uveal tract is involved, in which case the cyclitis and iritis require attention. The teeth, tonsils, sinuses, and intestines should be examined for foci of infection.

Sarcoma of the Choroid.—Intra-ocular sarcoma occurs after middle life. The patient complains first of a blur in the field of vision. With the ophthalmoscope a tumor is seen with the retina stretched over it. It is distinguished from simple detachment of the retina by the presence of blood-vessels which do not belong to the retinal circulation and by the fact that the pupil is dark when a bright light, properly protected except where it comes in contact with the eye (transilluminator of Würdemann), is directed through the sclera over the area corresponding to the situation of the tumor. At other points the pupil glows with a red reflex.

Sarcomata grow slowly until they cause secondary glaucoma and later break through the eyeball. Metastasis in other parts of the body, especially in the liver, may appear at any time.

Treatment.—As soon as the diagnosis is established the eye must be enucleated. A certain number of patients escape metastases and local recurrences if the eye is enucleated in the earlier stages.

DISEASES OF THE OPTIC NERVE

Optic Neuritis.—We distinguish between two forms: the one, intra-ocular, involving the nerve head, the changes being seen with the ophthalmoscope; the other, retrobulbar and exhibiting only slight or no signs at the papilla.

Intra-ocular Optic Neuritis.—The ophthalmoscopic signs are swelling and congestion of the disk which blur its outlines. Small hemorrhages may be present. The blood-vessels are often enlarged and tortuous and

the adjacent retina may be involved in the edema. Cases vary through all grades of intensity. If the edema is marked and the nerve head much swollen, we call the condition "choked disk." The inflammation of the nerve may have descended from the brain (descending neuritis), or may be due to mechanical causes (intracranial pressure), as is the edema of choked disk, or may be due to toxemia. If the retina is extensively involved the process is called neuroretinitis. When the inflammation is severe and has run its course, an optic atrophy remains. Although in some cases of optic neuritis the vision is but little affected, as a rule there is considerable loss. The field of vision is also often contracted peripherally. Among the more common causes are syphilis, nephritis, lead poisoning, and many other forms of toxemia, infection of the accessory sinuses, meningitis, brain tumor and infectious diseases.

Treatment.—The cause, which lies outside the eye itself, calls for appropriate treatment. In cases due to intracranial pressure a decompression operation is often indicated in order to save the vision.

Retrobulbar Neuritis.—In the acute form this affection may show few ophthalmoscopic changes but there may be slight congestion and blurring of the disk. A central scotoma soon appears which may spread over the whole field, and atrophy of the temporal quadrant of the nerve with a permanent central scotoma may result. The causes are toxic.

The chronic form shows involvement of those fibers of the optic nerve which supply the macular region and there is pallor of the temporal side of the nerve. There is a central color blindness especially for red and green and later for white, more or less complete. The cause is excessive indulgence in tobacco, especially if alcohol is also used. Some other poisons may also produce the same changes. The process is a chronic interstitial inflammation of the macular fibers of the optic nerve.

Treatment.—This consists in forbidding the use of tobacco and other poisons and giving large doses of strychnin.

Optic Nerve Atrophy.—Atrophy is divided in two classes, primary and secondary. The first (or simple atrophy) shows a white or gray nerve head with sharp outlines and is associated with diseases of the brain or spinal cord, such as disseminated sclerosis, locomotor ataxia and general paralysis of the insane. It appears also in general diseases, as syphilis, arteriosclerosis, etc.

Secondary atrophy follows optic neuritis or is the result of pressure on the optic nerve from a tumor in the orbit or an enlarged hypophysis, or from traumatism to the nerve.

Treatment.—This is of little avail. Vigorous antisyphilitic treatment should be instituted in cases due to lues. Strychnin and iodid of potash may be prescribed. Electricity is hardly profitable to the patient.

Wood Alcohol Poisoning.—The atrophy of the retina and optic nerve which follows poisoning with wood alcohol must be mentioned. These

cases are now more common than formerly for obvious reasons. Soon after the ingestion of the poison, the patient becomes dizzy, nauseated and suffers from headache. The vision becomes blurred even to total blindness, the pupils are wide and do not react to light. The ganglion cells of the retina are the seat of the lesion, but degeneration of the nerve fibers of the retina and optic nerve follows. There may be a temporary improvement in the vision before the atrophy sets in.

Treatment.—If seen early the stomach should be evacuated, diaphoresis established and strychnin administered. Later large doses of strychnin are indicated.

ERRORS OF REFRACTION AND ACCOMMODATION

In the normal eye, light from an object at least twenty feet distant, and hence practically parallel, is focused upon the retina, provided the accommodation is at rest. Accommodation is the ability which the eye possesses to change its refractive power so that, when an object is brought nearer to the eye and rays of light emanating from it are more divergent as they strike the cornea, they may still be brought to a focus on the retina. In order to change the refractive power of the eye for this purpose, it is necessary to increase the convexity of one of the refracting surfaces, because the more convex a lens is, the more the rays which pass through it are bent. The cornea, where most of the refraction takes place, cannot change its curvature; but the crystalline lens can and does, because it is elastic and tends to become spherical when the tension on the suspensory ligament and the ciliary body is released. Accommodation is, therefore, the act of contracting the ciliary muscle, relieving the tension on the suspensory ligament and allowing the lens, especially its anterior surface, to assume a more convex form. The knowledge of this principle is the key to the understanding of a good part of the subject of eye strain. Concerning the methods employed in the determination of the errors of refraction and accommodation, it must be said that these can be learned only by extended experience in clinical work. The means which are employed are the ophthalmoscope, retinoscope, ophthalmometer and a set of testing lenses.

Hypermetropia (Far-sightedness).—This error of refraction is defined as a condition in which parallel rays of light, with the accommodation at rest, come to a focus behind the retina. The eyeball is too short or the refractive surfaces are not convex enough. Since eyes have the ability to increase their refractive power by exerting the accommodation, they will do so under these circumstances and a clear image will be obtained. It is easy, therefore, to understand why hypermetropic patients develop eye-strain. They must accommodate for objects near at hand, but the effort

is in excess of the normal because they have already exerted a certain amount of accommodation to correct their hypermetropia. Patients with hypermetropic eyes suffer from asthenopia. This is a term used to include the symptoms, direct and reflex, which arise from eye-strain as a result either of errors of refraction or errors of motility. These symptoms are the blurring and running together of the print, pain and fatigue in the eyes, headaches, dizziness, gastric disturbances and neurasthenia. The blurring, fatigue and headache are generally worse when the eyes have been used for continued near work or with a poor light. The headaches are mostly frontal, sometimes general or occipital, rarely temporal. The patient may awake in the morning with a headache after using the eyes the night before. Migraine (hemicrania) is not caused by eye-strain but may perhaps be aggravated by it. Chorea, epilepsy, tic and other nervous manifestations have been attributed to eye-strain, but such views rest upon theoretical reasoning rather than actual evidence.

In obscure cases when the cause of the headache or other complaints is not perfectly understood, it is wise for the general practitioner to direct his patient to an ophthalmologist in order that any error in the eyes may be properly corrected. These corrections have at least one virtue, in that they do no harm, which is more than can be said for indiscriminate dosing with coal-tar products.

Treatment.—It is the usual custom to instill atropin (0.5 per cent), especially in children, three times a day for three days, in order to determine the exact refraction. It is most necessary in myopia, so that any contraction of the ciliary muscle which would increase the apparent error may be eliminated. Homatropin (1 per cent) accomplishes the same purpose if dropped into the eye two or three times during an hour.

Hypermetropia is corrected by placing in front of the eye a convex lens, thus relieving the eye from exerting its accommodation to correct the error. If a lens is given of a strength equal to or somewhat less than the hypermetropia, the eye will accommodate for near objects without fatigue as it has no extra work to do.

Myopia (Near-sightedness).—Myopia is defined as a condition in which the eye is too long. The focus falls in front of the retina. It will be seen that this error cannot be corrected by any effort because the accommodation will bring the image still further forward. It is only by bringing the object of fixation nearer to the eye that the focus can be thrown back upon the retina.

Myopia is rarely congenital but has its onset at the age of eight to twelve years and may progress until the patient has reached the age of twenty-one. After that it does not increase. The stretching of the eye at the posterior pole (posterior staphyloma) is accompanied by changes in the choroid and other complications, such as hemorrhages and detach-

ment of the retina, which are liable to appear in later years especially when the myopia is of high degree.

Treatment.—The vision of the myopic eye is corrected by concave lenses of a strength sufficient to carry the focus back to the retina. The accommodation will then be exerted normally for the near point if the individual is not old enough to have lost his ability to accommodate. There is no more important matter connected with the subject of refraction than incipient and progressive myopia. The child, who usually has a hereditary predisposition, is discovered to have defective vision for distant objects. This discovery is usually first made in school. These children should be made to wear the proper glasses constantly and the amount of near work should be limited, especially under artificial light, for almost without exception the young myope is fond of reading. The posture should be corrected, if he is inclined to stoop over his work, and the illumination must fall upon the page from the side and be of proper intensity. If the myopia shows a disposition to increase rapidly, it may be necessary to take the child from school for a year and prescribe an out-of-door life. In view of the serious lesions which complicate the progress of myopia or which may appear even in later life, too great attention cannot be given to the treatment of these cases.

Astigmatism.—This is an error of refraction due to the fact that the curvature of the refractive surfaces varies in different meridians. The eyeball is shaped like a lemon instead of an orange. If the variation is due to an uneven cornea, it is called irregular astigmatism. This, of course, cannot be corrected by lenses.

Regular astigmatism is classified according to the kind of refraction in the meridian which varies most from the normal; for instance, if one meridian is normal or emmetropic and the meridian at right angles hypermetropic, the error is called hypermetropic astigmatism. In mixed astigmatism one meridian is hypermetropic and the other myopic. Individuals with astigmatic eyes suffer from asthenopia, that is, blurred vision, headaches, etc.

Treatment.—Fortunately the optician can grind a glass which will refract light in one meridian only so that a cylinder can be fitted to such an eye and change the refraction of one meridian to such an extent that it brings the refraction of that meridian to that at right angles to it, in other words corrects the astigmatism.

Errors of Accommodation (Presbyopia).—The power of accommodation gradually lessens until at about forty-five years of age most individuals are unable to see clearly when objects are brought as near as fourteen inches, which is about the reading and general working distance. Presbyopia has then begun. Sometimes headaches and dizziness will be caused by the effort to use the eyes. Practically all accommodation is lost during the next ten or fifteen years.

Treatment.—During the period of failing accommodation, persons should be given, from time to time, convex lenses of a strength which will, with the accommodation available, bring the near point to fourteen inches. The final glass will be a convex lens, of fourteen-inch focus.

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DISEASES OF THE EAR

CHAPTER XXVIII

OTOLOGY

ARTHUR B. DUEL

During the past two or three decades there has been a growing tendency, on the part of general practitioners of medicine and surgery, to acquire a working knowledge of otology.

Indeed it is hardly possible for the diagnostician, in any branch of medicine, to ignore the ear as a factor in his problem, at some time or other; and he soon finds that the acquisition of a certain amount of skill in the use of a headlight and aural specula, or the application of a few fundamental functional tests, have enabled him to arrive at a positive conclusion, where, otherwise, without the aid of an otologist, he would have been uncertain.

This is particularly true in the case of the pediatrist, where otitic complications so frequently explain puzzling conditions with which his little patients confront him. I know of no pediatrist who to-day thinks of visiting his patient without some equipment for examining the ear, any more than he would think of neglecting to use a stethoscope or some method of illuminating and inspecting the nose and throat.

To neglect an examination of the ears in an infant suffering from any febrile disturbance would not only be unfair to his patient, but, in addition, would be exceedingly unfair to himself, since it would often lead him far afield in his diagnosis.

Furthermore, the pediatrist has learned that routine examination of ears, in patients having any of the acute exanthemata, whooping-cough, influenza, pneumonia, typhoid fever, infantile paralysis, or, as a matter of fact, any condition with a febrile movement, has often enabled him to discover an inflammation of the middle ear and to forestall more serious complications by early incision of the drum membrane.

The frequent development of a serious ear complication in some little patient, without attention having been called to it, shows how essential the routine examination is in older children, as well as in the infant too young to discuss his symptoms.

In a sense, this also applies to adults, and it is not unusual to find

the general practitioner, and especially the consultant, called in on a puzzling case, making an aural examination as a part of his routine.

Those who have wisely followed this routine know full well how often it has unexpectedly led them to the solution of a puzzling case, and occasionally forestalled the later call of the otologist to a serious or possibly precarious surgical situation.

A sufficient familiarity with the ear for an early diagnosis of the usual surgical conditions, with typical manifestations, and of the usual functional disturbances, where the reactions to a tuning fork acoumeter and whisper are fairly well standardized, may be readily acquired.

It is quite unnecessary for a comfortable working knowledge of the ear that a general practitioner should know the anatomical relation of the ossicles; or the position of Prussak's space in the tympanum; or the position and function of the membrana tectoria, and the crista galli; or the relation of the facial nerve to the superior vertical semicircular canal; or that the aqueductus cochleæ opens directly into the arachnoid space, while the aqueductus vestibulæ opens into a culdesac of dura; or the much-discussed Helmholz theory of sound perception; or the differential diagnosis between a dead labyrinth and an abscess of the cerebellum.

All these and many other facts and questions may well be left to the specialist, who, in all conscience, will spend a lifetime over them, finally leaving many of them unsolved.

But, on the other hand, the general practitioner, who wishes to assume the responsibility of settling the aural problems for his patient up to a certain point, must learn to focus a light from a head mirror through an aural speculum, or use a specially constructed, self-illuminating speculum. He must learn to recognize the difference in appearance of a shining, translucent normal drum membrane with its cone of light, made by the reflection from a surface at an angle from the perpendicular. He must learn to detect the loss of luster which comes from beginning congestion, and the changes which take place from that normal, translucent luster, from pinkness to the dull beefy redness and bulging of a well-developed middle-ear abscess.

If he would give an opinion on an impairment of hearing, as to whether it is of the conducting or receiving apparatus; as to whether it is chronic or acute; as to whether it is a condition which may, or may not, be improved or cured by treatment; he should have some knowledge of the behavior of such cases to standardized functional tests.

This facility of diagnosis, for the majority of cases, may be acquired with a moderate outlay of patient and careful effort. With this equipment the general practitioner will be quite certain of the cases which he can safely attempt himself, and those in which he should place the responsibility in the hands of the specialist.

I shall endeavor, in the space allotted to me, to point out the more

essential features of the subject which are likely to be met first by the general practitioner in everyday practice.

There will be many otological subjects which will not be dealt with in this short chapter. Those who wish to study these subjects will naturally consult the recent works in that special branch of surgery, where the more unlimited space permits a fuller discussion.

Since this article is not intended for specialists, there will be no discussion of mooted questions; the writer will simply point out, in a somewhat didactic way, his own opinion about the subject in hand.

For purposes of study and description, diseases of the ear may be conveniently classified as lesions of:

Conducting Apparatus.—The auricle, auditory canal, drum membrane, ossicles, middle ear, eustachian tube, mastoid process.

Receiving Apparatus.—The labyrinth with the end organs of the two branches of the eighth nerve. The auditory, which has its end organ in the cochlea, the sound-perceiving apparatus. The vestibular, with its end organ in the vestibule and semicircular canals, which, together with the cerebellum, controls the static sense.

It may be further divided into lesions in which the important issue is:

Functional

1. Loss of hearing,
2. Loss of equilibrium: from conditions in which there is no menace to the patient other than the functional impairment, or where the important problem becomes

Surgical—in that

Infection of

1. Auditory canal,
2. Drum membrane,
3. Middle ear, or
4. Mastoid process,

or Extension to

5. Internal ear,
6. Lateral sinus (septic thrombosis),
7. Epidural abscess,
8. Intradural abscess,
9. Meningitis,
10. Encephalitis,
11. Brain abscess,
    - *a.* Cerebrum,
    - *b.* Cerebellum,

may present a menace to the life of the patient which temporarily forces the question of function into the background.

Any surgical condition may affect the function of hearing, or equilibrium, temporarily or permanently, and in every instance function must be taken into consideration, either as paramount or secondary, depending on the nature of the lesion.

We shall then take up in order lesions of the external ear, middle ear and internal ear, first considering conditions in which impairment of function is paramount; next considering the conditions in which the surgical menace to life forces the question of function into the background.

EXTERNAL EAR

Impacted Cerumen

Plugs of cerumen collect in one or both canals; in some instances, very rapidly, in others, very slowly. In either case there is very little loss of hearing or discomfort to the patient until the plug completely fills the canal, or, by some ineffectual effort at removal, is pushed inward until it touches the drum membrane. There immediately ensues a profound loss of hearing. The patient complains that he suddenly became deaf in one or both ears. This usually occurs following the introduction of water in the canals, while surf bathing, or diving in a tank, or from a shower bath. The introduction of water causes a sudden swelling of the plug of cerumen, either completely occluding the canal or displacing the plug inward until it touches the drum.

On inspection through the aural speculum, the mass of brown or black cerumen is readily seen. Not infrequently there is a liberal admixture of epithelium from the canal wall, which may give the mass a yellowish white appearance.

The only possible conditions with which this might be confused are cholesteatoma and aspergillus. (1) *Cholesteatoma*[1] could only occur in a case where there was a history of a chronic discharging ear with long-continued loss of hearing. The mass would be shining white, like the layers of an onion. Under a microscope of low power, cholesterin crystals would appear. In *aspergillus*[2] the canal would not be entirely occluded, and there would be a history of intense itching and irritation. The canal would have the appearance of being moist, with a moldy growth of pure white and an occasional black top on some of the fungi. These could be partially wiped away in soft cheesy masses. Smeared on a microscopic slide under a low power the spores and vegetable stems of aspergillus would show very readily.

[1] See O. M. P. C.

[2] See Aspergillus.

Treatment.—Under no circumstances should an attempt be made to remove impacted cerumen by any instrumentation. The use of curets or forceps for this purpose is most reprehensible except in the most skillful hands. Even then, instruments should never be used if the plug completely occludes the canal or touches the ear drum.

All plugs may be readily removed by the use of a large Pomeroy ear syringe, by means of which repeated jets of lukewarm (temperature 102° to 105° F.) water, containing a teaspoonful of sodium bicarbonate to the quart, are applied; always directing the stream against the periphery of the plug, posteriorly and superiorly in the canal. If the patient or an assistant holds a large pus basin against the side of the neck, well below the ear, to catch the water as it drips from the flange of the syringe, the operator will then have the left hand free to grasp the auricle and gently pull it backward and upward to straighten the canal, which will greatly assist in dislodging the impacted plug.[3] The stream should be ejected with moderate force, always directed at practically the same spot, with many repeated applications. I not infrequently use two quarts of water, and occasionally much more, before the plug is dislodged.

If one fails after patiently trying this method, he should never resort to instruments. The patient may be laid down, or the head tilted to one side, the canal and concha of the ear filled with hydrogen peroxid, and allowed to remain for five minutes. This seldom fails to soften and disintegrate the mass so that a few syringefuls of the alkaline solution will dislodge it.

However, should this fail, give the patient an alkaline solution (Sodii Bicarb. gr. xx., Aq. Dest. ℥i) and a medicine dropper with directions to drop five or ten drops in the ear and lie with that ear up for five minutes, this to be repeated four or five times during the day, and to return the following day for a repetition of the syringing rather than make the effort at removal by instrumentation.

The plug once removed—and it is usually done in a fraction of the time I have taken to describe the method—the canal should be dried by laying a long soft wick of absorbent cotton in the canal for a few seconds. The relief to the patient, and the sudden restoration of the hearing on removal of the plug and drying the canal, will well repay the careful effort.

Foreign Bodies in the Canal

The introduction of foreign bodies in the canal—such as paper wads, glass beads, buttons, peas, beans, or other grains—is a common practice among children. In an effort to extract these foreign bodies, they are often forced farther in and, unless painful, may remain for long periods until some inflammatory reaction calls attention to them.

[3] In young children the auricle should be gently pulled straight backward.

Occasionally a live insect, a fly, ant, cockroach, or any kind of bug, may crawl into the auditory canal and become entangled in the hairs or cerumen and be unable to extricate itself. The torture to the patient by these efforts of the insect is often excruciating.

Treatment.—The instillation, in the auditory canal, of a 1:1,000 solution of bichlorid of mercury, in such a case, will almost immediately kill the insect, thus stopping the agony. The use of a Pomeroy syringe as described in the removal of cerumen will then wash out the intruder.

The removal of other foreign bodies should be accomplished in the same manner. Failure in children is often due to their struggles, which prevent the injection of the jet of water in exactly the right direction. In such cases, it is better at the start to administer an anesthetic, inasmuch as no instrumentation should be attempted with a struggling patient. Even under an anesthetic, instrumental removal of foreign bodies should not be attempted except by one who is skilled and has the proper instruments for the purpose.

I have dwelt long on this idea, both in the question of cerumen and other foreign bodies, because I have seen most serious consequences, even loss of life, result from accidental rupture of the drum, and long and painful, sometimes deforming chondritis following wounds of the canal wall, due to bungling instrumentation.

I firmly believe that foreign bodies which cannot be removed by syringing should be turned over to a skilled specialist, who will himself have to use the greatest caution to avoid the dangers I have pointed out.

Functional Testing of Hearing

As I have intimated, loss of hearing may be due to a lesion of the sound-conducting mechanism, or the sound-perceiving mechanism. Loss of hearing from lesions of the *conducting mechanism* are usually spoken of as *middle-ear deafness,* while that from lesions of the *perceiving apparatus* is called *nerve deafness.*

In a general way it may be said that about the same amount of apparent deafness may arise in any given case from a lesion of either the conducting or receiving apparatus. The question of probable relief from general or local treatment, and the kind and amount of such treatment, depends wholly upon an accurate diagnosis of the lesion. In order that the best intelligence may be applied to any case with beginning loss of hearing, it is highly important that the earliest possible diagnosis of the nature of the lesion causing it should be made.

Whenever the general practitioner comes in contact with such a case, his responsibility toward it should lead him to investigate it sufficiently to know that it is one in which active efforts may be of great service in restoring or preserving the function, or, on the other hand, that it is

one in which treatment of any kind will make little or no difference with its progress.

It follows that such cases either should be sent to an otologist for an opinion, or that the physician himself should be sufficiently familiar with the patients' reactions to a few functional tests to determine these points.

The more elaborate series of tuning forks and other instruments for functional testing usually employed by otologists are not necessary in the majority of cases. To gain an intelligent conception of any case, however, the following instruments should be at hand:

1. A head mirror which focuses light at 9 to 12 inches.
2. A nest of aural specula. (In place of 1 and 2 an electrically illuminated speculum may be employed.)
3. A nasal speculum.
4. Two tuning forks.
   a. Very low pitch, that is, below 64 double vibrations per second.
   b. Medium pitch, that is, 256 double vibrations per second (C).
5. A Galton whistle, for very high vibrations, say from 10,000 to 30,000 double vibrations per second.
6. A Politzer acoumeter, or loud ticking watch, like the Ingersoll.
7. A noise apparatus: a little clock-work apparatus designed to completely drown out the hearing in one ear while the other is being tested for absolute deafness.

With this modest equipment, and a knowledge which enables one to interpret the results of a patient's reactions to them, any case which could not be accurately classified would be likely to prove puzzling to any expert. The more elaborate outfit might be very useful in measuring the progress of a case, or in giving a prognosis, but it would not be of great additional service in determining the kind of deafness from which the patient suffered.

In functional testing, certain fundamental principles should be borne in mind, as follows:

1. The normal ear has a range of hearing for musical tones from 16 double vibrations per second (the lowest organ pipe) to about 30,000 double vibrations (the shrillest whistle). Sound vibrations are heard in the normal ear much longer by air conduction (through the normal conduction mechanism of the drum membrane and ossicles) than by bone conduction (that is, the bones of the cranium).

a. A 256 tuning fork in vibration will be heard for several seconds when held close to the auricle (air conduction) after vibrations from it cease to be heard when the handle is pressed against the mastoid bone (bone conduction).

b. A 256 v.s. tuning fork in vibration, pressed against the vertex

of the skull, the middle of the forehead, or point of the chin, will be heard equally well in both ears, if both are normal. The slightest pressure against either external auditory canal (obstruction of the conduction apparatus) causes the sound to be heard louder on that side.

2. Any lesion *in the conducting apparatus,* causing loss of hearing (middle-ear deafness), whether acute or chronic, inflammatory or otherwise, whether mechanical from the presence of foreign bodies, or swelling of the external auditory canal, or catarrhal obstruction of the eustachian tube or tympanum, will show:

a. A raising of the lower tone limit, depending on the amount of obstruction.

b. Practically normal upper tone limit, that is, 1.0 to 2.0 on the spiral rings of the Galton whistle.

c. A 256 tuning fork in vibration, with the handle pressed firmly on the vertex, the middle of the forehead, or the tip of the chin, will be heard louder on the affected side. If both sides are obstructed, the fork will be heard louder on the deafer side.

d. A 256 fork in vibration will be heard when the handle is pressed firmly on the mastoid process, long after it ceased to be heard by air conduction. This discrepancy will be more apparent as the obstruction from whatever cause becomes more marked. This is exactly the reverse of the relation in normal ears, or in deafness due to lesions on the perceiving apparatus.

3. Any lesion of the *perceiving apparatus* causing loss of hearing (nerve deafness), whether acute or chronic, whether from acute infection, or toxemia from mumps or measles or from drugs, or from syphilis, will show:

a. A lowering of the upper tone limit down to 5.0, 10.0 or even 20.0 on the rings of the Galton whistle, depending on the nature and severity of the lesion.

b. The lower tone limit may not be raised except in cases of extreme loss of hearing. In any case, the lower tones will be lost last.

c. A 256 tuning fork in vibration, with the handle pressed closely on the vertex, middle of the forehead, or point of the chin, will be heard louder in the normal ear, or, if both are affected, in the better ear.

d. A 256 tuning fork in vibration will be heard by air conduction in front of the auricle long after the patient ceases to hear it when the handle is pressed against the mastoid. This maintains the normal relative relation of bone and air conduction, although, compared with the normal ear of the examiner, both will be reduced in the length of time the tuning fork is heard.

4. Bearing these facts in mind, it will be easily understood that:

a. In deafness due to lesions of the *conducting apparatus* (middle-ear deafness) from any cause, high-pitched voices will be heard better

than low ones. Bells, whistles, birds and insects may be heard when voices are missed or heard with great difficulty. The accompanying tinnitus is liable to be pulsating in character, and low pitched in tone.

b. In deafness due to lesions of the *receiving apparatus* (nerve deafness), low-pitched voices may be heard more easily than high-pitched ones. Insects, birds, whistles and bells may be missed, while conversation, foghorns or the ticking of a clock may be heard. The accompanying tinnitus is liable to be continuous in character, and high pitched in tone.

We may now take up the *conditions affecting the hearing* which are *non-surgical* in the sense that there is no acute inflammation which presents a menace outweighing the loss of function.

Catarrhal Forms of Deafness

Eustachian Tubal Catarrh.—This is manifested by a catarrhal swelling of the mucous membrane of one or both eustachian tubes. Both are usually involved, though almost invariably one is worse than the other.

The swelling mechanically obstructs the lumen of the tube, so that the act of swallowing does not completely change the air in the middle ear. The oxygen from the air in the middle ear is gradually absorbed by the engorged blood-vessels. The consequent rarefication causes an unequal pressure on the drum membrane. It is therefore mechanically pushed in by the heavier external air pressure, causing a retracted drum membrane. At the same time, the loss of pressure in the tympanum allows a passive venous congestion to take place. Thus mechanically the conduction of sound is interfered with, in much the same way that the laying of a soft pad of cotton on the drum would affect it. At the same time, a low-pitched, pulsating tinnitus is caused, by the passive venous congestion.

Both the tinnitus and the impaired hearing vary from hour to hour, and from day to day, depending on the temperature, humidity, position, whether the patient is exercising or quiet, etc.

The condition of the nose and nasopharynx, whether free and clear or congested, usually determines the condition of the ventilating tubes, and consequently the symptoms vary as often as changes take place in the accompanying nasopharyngitis.

Treatment.—Relief of the obstructed eustachian tubes should be directed first to removal of obstruction in the nose and nasopharynx.

In acute rhinitis, or rhinopharyngitis, temporary relief may be obtained by cleansing sprays of normal saline solution, mild alkaline antiseptic sprays, a 1 : 10,000 solution of adrenalin chlorid, followed by a nebulized oil containing menthol or eucalyptus. A number of elegant preparations, all about equally efficient, are supplied by proprietary druggists.

After the engorgement of the nose and nasopharynx has been reduced, the introduction of air through the eustachian tube by means of a Politzer bag or eustachian catheter affords great temporary relief. Repeated inflation from day to day shortens the duration of an acute tubal catarrh to a few days, which might otherwise persist for weeks, or even pass into a chronic state.

The use of the Politzer bag or eustachian catheter is not entirely free from danger, as infection from the nasopharynx or eustachian tube may be forced into the middle ear, thereby starting up an acute otitis. They should not be attempted without some special training.

Nasal obstruction, from whatever cause, and nasopharyngeal obstruction from hypertrophied adenoids and tonsils should be removed when present.

Subacute or Chronic Eustachian Tubal Catarrh.—This condition is merely a prolongation of the symptoms of the acute form. Obstructions in the nose from a deviated septum, enlarged turbinate bodies, chronic ethmoiditis, chronic suppuration of nasal accessory sinuses, hypertrophied adenoids and tonsils, are usually responsible for the condition. Treatment of the eustachian tubes affords only temporary relief. Surgical relief of these conditions when present, by removal of the obstructions of whatever nature, is indicated.

Acute Catarrhal Otitis Media.—This condition is just another step in the same process. The constant passive congestion of the middle ear may cause an exudate of serum. If the opening of the tube, by depleting the engorged nasopharynx and inflation, does not affect its disappearance, by drainage or absorption, it may occasion sufficient pressure to cause pain. In such a case, the symptoms are quite similar to an acute purulent otitis but may be without temperature. A puncture of the drum membrane then becomes necessary.

Chronic Catarrhal Otitis Media.—Prolonged obstruction of the eustachian tube from the foregoing causes, with the accompanying congestion, brings on a gradual hypertrophy of the lining mucous membrane. The lack of ventilation, which was intermittent in the early stages, becomes permanent. There is consequently a permanent retraction of the drum membrane, and the ossicular chain is mechanically impeded in its movements. The hearing gradually becomes more and more impaired, and the tinnitus increases in intensity. Bands of adhesion may form across the lumen of the eustachian tube or in the middle ear. Later on in the course of the disease, the hypertrophied tissue undergoes an atrophy. These bands then still further impede the mobility of the ossicular chain.

Treatment.—It is evident that in all these so-called catarrhal forms of deafness, the impediment of hearing is always mechanical. First by congestion and stoppage of ventilation; then by hypertrophy of mucous membrane; then by atrophy and binding of the ossicular chain.

Therefore, the earlier the treatment which prevents this mechanical impediment, the more likelihood of success.

In the early stages, prompt removal may stop the tinnitus and completely restore the hearing. In the later stages, relief will be afforded just in so far as one is able to check or restore this immobility by removal of the mechanical impediments.

The amount of activity in any case, then, depends upon the stage of progress, and the nature of obstructions.

In young children, the prompt removal of adenoids and hypertrophied tonsils and the correction of nasal deformities may completely cure a condition which, if allowed to drift on, might have eventually resulted in marked deafness of a chronic type.

In young adults, the correction of such obstructions may arrest the course of a chronic deafness, or restore an amount of hearing which will be of tremendous benefit to the life work, and happiness of the patient.

On the other hand, where marked deformities are present which have already done their mischief, it may be a grave question as to whether they should be removed. A fair test, in such a case, would be the reaction in hearing which temporarily follows a catheter inflation of the ears. If the result of inflation is a temporary brilliant improvement, which in a few hours slumps back to the original loss, such a case should have every possible effort made to restore the ventilation of the middle ear.

Removal of all nasal and nasopharyngeal obstructions, the passing of eustachian bougies, and regular catheterizations and inflations, should follow at intervals frequent enough to keep the hearing on the highest attainable level, and the tinnitus aurium at the lowest possible amount.

In other words, catarrhal deafness may be cured or arrested in the early stages, and intelligent efforts at that time cannot be too persistent or aggressive.

Catarrhal deafness in its later stages can only be alleviated, or perhaps not benefited at all; the amount of effort advisable in such a case can only be judged by the amount of relief afforded.

The great mistake in any given case is to abandon efforts during the early stages, because inefficient efforts in some other case similar to it had proved ineffectual. Every case of catarrhal deafness has the right to the attention of the best available specialist at the earliest possible moment. If there was ever any truth in the old adage that "a stitch in time saves nine," it is true in catarrhal otitis media.

Deafness from Disease of the Bony Capsule of the Labyrinth: Otosclerosis

This is a disease beginning early in adult life, and, in a large percentage of cases, is progressive throughout the life of the individual af-

fected. In very rare instances it may begin before twenty. In most instances it first manifests itself around twenty-five. Occasionally it does not appear until middle age. Almost invariably there is a history of deafness beginning in early adult life in one or both parents. In some instances the parents may have been free from it. In such cases, however, a history of deafness beginning in early adult life in uncles or aunts, or in one or more grandparents on one or both sides of the family, can usually be elicited. Without this history somewhere in the ancestry, even in cases where the functional tests are typical, a positive diagnosis should not be made until the progress of the disease, under careful observation and treatment, has proved most convincing.

The lesion, in otosclerosis, is a spongification of the bony capsule surrounding the labyrinth. These islands of rarefication take place irregularly in different parts. In those cases where the activity is in the region of the oval window, a fixation of the stapes takes place. Such cases show a much more marked deafness and a more intense tinnitus than when the process is confined to other parts of the capsule.

The first manifestation of the disease is usually a low-pitched tinnitus and impaired hearing in one ear, soon followed by the same condition in the other. It may be months or even years before the second one is noticeably involved. It seldom happens that both are equally impaired. Not infrequently a rapid impairment takes place in the better ear, so that the one on which the patient depended suddenly becomes the deafer ear. The tinnitus is variable, at times quite mild, so that it is hardly perceptible, and again quite loud and distressing, so that it is the chief complaint of the patient. As a rule the amount of tinnitus goes pari passu with the loss of hearing; indeed the confusion of sound resulting from the loud tinnitus is often the cause of as much impairment of hearing as that occasioned by the impediment of sound waves by the physical changes in the auditory apparatus. The patient hears better in noisy places.

Long periods, even years, may go by without any noticeable change only to be followed by a sudden slump in one or both ears following an illness which depletes the general health. In women, pregnancy is often the potential factor in a decided slump in otosclerotics.

Treatment.—Inasmuch as the lesion is of the bony labyrinthine capsule, it is useless to expect any improvement from the usual efforts in the way of inflations, vibratory massage, etc., which may have some effect on the catarrhal types of deafness I have previously discussed.

However, it must be borne in mind that otosclerotics are just as susceptible to catarrhal processes as others, and when, as often happens, catarrhal middle-ear deafness is present, in addition to the otosclerosis, much help may be afforded by all the activities I have spoken of in connection with the treatment of the catarrhal processes.

Much confusion has resulted from failure to differentiate these con-

ditions, and much criticism (often just) has been heaped upon the otologist for putting them all on the same shelf and treating them all alike. A more careful diagnosis in the beginning would often lead to a more accurate prognosis and less enthusiasm in their efforts to relieve the purely otosclerotic cases by persistent local treatment.

It is very probable that, being a hereditary dominant defect, it follows the laws of Mendel and that the only way to stamp out otosclerosis is by breeding it out. So convinced were the German scientists of this that marriage of otosclerotics was forbidden more than a decade ago. If an otosclerotic were to marry a normal, under the Mendelian law only one of every three ova could inherit the defect. In animals, where every ovum can be impregnated, where the state of maturity is reached early, and where, therefore, many generations can be studied in a short period, physical defects of this character have been proven to be transmitted with great accuracy. It can easily be seen in the human animal, however, how difficult it is to prove it except by analogy, inasmuch as the number of impregnations as compared with the total number of ova is very small; the mature age when the defect manifests itself makes it impossible for one observer to see in a lifetime more than two or possibly three generations. Then, too, if only one in three ova can contain the defect, one can see how in one family the luck might run so that a non-defective ovum was impregnated in each instance, whereas, in another, the two non-defective ova might be skipped in each pregnancy, with the result that all of the offspring would prove to be otosclerotic. It must also be borne in mind that, if the Mendelian law was working accurately, the union of a non-defective, the offspring of a normal and a defective, with another non-defective, also the offspring of a normal and a defective, would bring about the result that two people who were not deaf at all would propagate a family, all of whom would have otosclerosis. The results are far-reaching, and, while the proof is almost impossible, the theory is probably correct.

The answer is perfectly obvious if one is looking at the subject purely from a eugenic point of view; on the other hand, it is true that many of the most important characters in history have had otosclerosis.

So far as the *treatment* of the individual case is concerned, attention to the general health is of more importance than local treatment, except where there are catarrhal complications. Phosphorus in some assimilable form may have some effect on the bony changes, and I usually prescribe a course of it every year. After all, it is purely empirical, and one never feels quite certain that an apparent improvement in any given case may not be like the long periods of quiescence which occur in others without treatment.

The subject of otosclerosis is likely to remain unsolved until an endowment for laboratory study is made to some institution. Self-perpetuating investigators can then pursue the scientific study of families through sev-

eral generations, with accurately tabulated results. The result may be that a developmental defect probably arising from the lack of or oversupply of a certain endocrin will be discovered. Eventually along this line the defective supply will be regulated in prospective otosclerotics, so that the changes in the bony labyrinthine capsule will not take place. Otosclerosis will then be wiped out. Whoever makes this possible, and whoever makes the discovery, will confer upon posterity one of the great contributions to medicine.

In the *functional test* of all *catarrhal forms* of *deafness,* and also in *otosclerosis,* the interference is with the *sound-conducting mechanism.*

Therefore the *lower tone limit* will be raised and the *upper tone limit* will *remain normal.*[4]

Bone conduction will be longer than air conduction. If a tuning fork in vibration be placed on the vertex or point of the chin the tone will be heard louder in the deafer ear.

Deafness Due to Lesions of the Receiving Apparatus: Nerve Deafness

Infection or toxic products from focal abscesses in teeth, tonsils, nasal-accessory sinuses, the gastro-intestinal tract, or, in fact, any part of the body, may cause a neuritis of the eighth nerve, just as it may involve any other nerve. The expression of such a neuritis in the eighth nerve is in the form of tinnitus of a high-pitched and continuous character and loss of hearing from the auditory branch; and vertigo and possibly nausea and vomiting from the vestibular branch. Either branch may be affected alone, although as a rule both are involved.

Where the involvement is sudden and violent, the picture of Ménière's symptom complex is presented. On the other hand, the dosage of toxins may be so small that the loss of hearing is gradual and the effect on the vestibular nerve is only manifested by an occasional slight vertigo. In the more violent attacks the patient is quite prostrated for a time, gradually recovers the equilibrium in whole or in part, regains a part of the hearing, and the tinnitus diminishes or subsides altogether. This is followed by a similar attack at longer or shorter periods, depending upon the source and virulence of the toxemia. Each attack is liable to do further damage to the nerve, and a functional test will show increasing deafness and further impairment of the static sense. The recovery of the balance in these cases is not due to a complete restoration of the vestibular apparatus, but rather to compensation. The compensatory powers of the static sense in the higher forms of prehensile organisms is tremendous. In the milder forms, where the vertiginous symptoms are slight and the

[4] In otosclerosis, where the stapes is fixed in the oval window, the upper tone limit may be greatly lowered.

deafness is variable, it is not unusual for much valuable time to be lost, owing to the fact that both patient and physician believe that treatment directed to the middle ear has caused a gradual improvement. This is one of the places where a functional test will save much time, and possibly much function, by an early diagnosis of deafness from involvement of the nerve.

The *lower tone limit* will not be raised—as it is in the catarrhal types and in otosclerosis—pari passu with the loss of hearing.

The *upper tone limit* will be lowered. The *bone conduction* will be less than air conduction.

The *tuning fork* on the *vertex* or *point of the chin* will be referred to the *better* ear.

These tests are all diametrically opposite to the tests obtained in the types where the conducting apparatus is involved.

Treatment.—Teeth and nasal accessory sinuses should be radiographed. Evidence of apical abscesses at the roots of teeth should call for their immediate extraction (teeth are of small value compared with hearing and equilibrium). Suppurating nasal accessory sinuses should be drained. Infected tonsils should be removed. In fact, sources of toxemia in any part should be sought out, and, where possible, eradicated.

Toxic Poisoning from Drugs.—Large and prolonged doses of quinin, salicylates, alcohol, tobacco and lead may cause a toxic neuritis of the eighth nerve which may temporarily or permanently cause symptoms similar to those just described.

Treatment.—Treatment consists in withdrawal of the drugs. Occasionally bromids are indicated, if the tinnitus is intolerable.

Syphilis.—Syphilis in the tertiary stage may bring about a sudden neuritis of the eighth nerve by actual invasion of the nerve sheath by the spirochetæ. Deafness of any degree, accompanied by loud tinnitus and vertiginous symptoms, may be present. The Wassermann test is positive—either for blood or spinal fluid, or both.

Treatment.—Salvarsan, both by blood stream and intraspinously, will be necessary. Occasionally brilliant improvement may follow prompt treatment. Usually the hearing will not be improved. Nevertheless, vigorous measures are necessary to forestall more serious intracranial syphilitic manifestations.

Mumps.—Profound loss of hearing occasionally occurs during the course of mumps. The symptoms may have been overlooked if the patient has been very ill. Vomiting, dizziness, ringing in the ears and marked deafness in one or both ears occurs. If only one ear is involved, a noise apparatus in the hearing ear will drown out the hearing, so that a test will show that even shouted words cannot be heard in the affected side. Often such a case is not discovered until long afterward, particularly in young infants. The hearing is usually completely lost. The equilibrium

is quickly recovered by compensation; nevertheless, a functional examination of the static labyrinth by the caloric test will show complete loss of the static sense on that side.

Diseases of the External Ear

Dermatitis and Eczema.—Dermatitis of the auricle and canal and mild cases of eczema will usually clear up readily if the patient is cautioned to keep water from the affected areas. They may be cleansed with dilute alcohol, and, after drying, smeared over with a thin layer of Ung. Hydrarg. Ammon., applied on cotton toothpick swabs.

Chronic Eczema.—Chronic eczema of the canals and auricle, which does not yield readily to this treatment, should be sent to a dermatologist.

Freezing and Burns.—Freezing and burns of the auricle should be treated as in other parts. Dressing with vaselin, zinc oxid ointment, or Lassar's paste relieves the pain in superficial burns or freezing. Deeper-seated injuries may cause a chondritis with eventual sloughing of cartilage, producing marked deformity. Early surgical intervention should be instituted in these cases to limit the deformity as much as possible.

Perichondritis and Chondritis.—Perichondritis and chondritis of the auricle may result from blows while boxing, or from other injuries. They may produce marked deformities of the auricle. The thickened and distorted ear of the pugilist is well known. Cold, or cold and heat alternately, for a few hours, may cause the milder cases to subside. Where an exudate or hemorrhage takes place, early incision and drainage may avert a very deforming slough.

Carcinoma.—Carcinoma of the auricle is fortunately very rare. These cases should be referred to the surgeon at the earliest possible moment.

Furunculosis.—External otitis may be circumscribed or diffuse. In either case, it is almost invariably due to infection by Staphylococcus aureus.

The inoculation is usually due to efforts to scratch the canal or concha, either with the finger nail, a hairpin, toothpick, etc. A slight abrasion of the skin results in infection.

The close connection of the skin with the cartilage of the canal allows very little expansion, and the inflammatory swelling is therefore very painful from the beginning. An early rise in temperature is common. The pain is pulsating in character and perhaps more intense and more continuous than the early stages of an acute middle-ear abscess. In the early stages a very good point in differential diagnosis, aside from inspection, is that the hearing remains normal until the swelling completely occludes the canal. Another and even better one is that pulling the auricle even the

least bit causes intense pain where a furuncle is developing, while it causes little or no pain in middle-ear abscess.

Postauricular swelling is much more frequently caused by a furuncle than by a mastoiditis. Great care should be exercised, when, as occasionally happens, a furuncle of the canal complicates a middle-ear abscess, not to confuse canal tenderness with mastoid tenderness, particularly when postauricular swelling is present.

Usually inspection shows a point of swelling in some part of the canal, and manipulation of the auricle is very painful. If the canal is not so badly swollen that the smallest speculum cannot be introduced, one is able to make sure that the drum membrane is shining and translucent. In the later stages where the canal is swollen, and possibly the furuncle has broken, it is often difficult to decide whether or not the middle ear is involved.

Treatment.—In the past few years, I have seldom resorted to anesthesia and deep incisions, either in circumscribed or diffuse external otitis. These incisions relieved pain at once, but I believe they also opened up areas of uninfected tissue which subsequently became infected and sloughed.

Furuncles of the aural canal, as in other parts of the body, form a circumscribed gangrenous area which sloughs away and is discharged as a "core." If an incision is made through this into healthy tissue, the reinfected area sloughs again and the process is prolonged. Occasionally incision in healthy cartilage may cause a chondritis which eventually sloughs away a large area and may cause marked deformity of the auricle.

By far the best plan, and the one which I have followed for several years, is to introduce a wick of cotton saturated with cresatin.[5] This alleviates pain, softens the skin, sterilizes the canal, and often prevents a series of boils by reinfection. These wicks may be renewed once or twice daily, until the furuncle "comes to a head," that is, a little white superficial slough occurs. If this is superficially incised with a very small scalpel and the gentlest pressure made with a soft cotton swab, the boil will discharge enough pus to relieve the pain. In a day or two the "core" will squeeze out and the whole process will subside much earlier than where a deep incision has been made.

Even when the pain is very intense, this practice, accompanied if necessary by morphin or codein hypodermically, will usually be better than deep incision under an anesthetic.

In the usual run of cases, a succession of boils is the rule. The early use of cresatin wicks not only offers the best hope for curing the first one, but, in addition, offers the best chance of sterilizing the canal and preventing these reinfections.

Nevertheless, it is wise to have an autogenous vaccine of the Staphylo-

[5] A proprietary name for metacresylacetate.

coccus aureus made from the first pus obtainable (500,000,000 to the cubic centimeter). In case a second or a series of furuncles occurs, the use of these vaccines, at intervals of five days, for from 4 to 8 doses, increasing from *3 minims* at the initial dose to *10 minims* at the eighth, is often of great benefit. In any case where recurrent furuncles are present, a careful examination of the urine for sugar should be made, inasmuch as the condition is so often a concomitant of diabetes mellitus.

Aspergillus; Leptothrix.—The diagnosis was discussed under the heading of cerumen. It is seldom confused. The appearance of a soft, velvety, moist growth, looking not unlike little bits from the head of a cauliflower spattered over the canal, is quite characteristic. This appearance, accompanied by the complaint of intense itching, and sometimes burning pain, makes the picture complete. A small tuft smeared on a slide and placed under a microscope shows the unmistakable stamen and spores of the vegetable growth.

Treatment.—Careful wiping away of the growth with cotton swabs moistened in an alcoholic solution of bichlorid of mercury (1:2,000) or a 1 per cent alcoholic solution of iodin, has been most efficacious. This treatment two or three times a week may have to be persisted in for several weeks before the growth is completely eradicated.

SUPPURATIVE DISEASES OF THE MIDDLE-EAR AND MASTOID PROCESS

Acute Suppurative Otitis Media

Infection carried through the eustachian tube to the tympanum sets up an inflammation in the mucous membrane lining both. The swelling of the tube occludes the lumen and, thus preventing ventilation and drainage, favors the formation of an abscess in the middle ear.

The first inflammatory reaction causes an exudate of serosanguineous fluid into the tympanum. This soon becomes purulent in character. The inflammatory congestion may cause pain from the onset; a sharp rise in temperature, depending somewhat upon the virulence of the infection; and impairment of hearing. As soon as the exudate into the middle ear is sufficient to cause pressure, the pain becomes excruciating and the loss of hearing is very marked. The pain may be intermittent. This is due to the fact that the fibers of the drum membrane stretch or yield to the pressure, which temporarily relieves the tension, only to be put on the stretch again as the fluid in the middle ear increases in volume. This usually goes on until rupture of the membrane relieves the excruciating pain, which then changes to a dull ache. In other words, the pain depends largely upon the amount of pressure.

Not infrequently, where the infection is from a gas-forming organism, the pressure from the gas resulting from the growth may cause bulging of the drum membrane and pain, long before fluid appears in the middle ear.

Such infections are likely to appear as a result of extension from the nasopharyngitis accompanying influenza, any of the acute exanthemata, pneumonia, whooping cough, etc. Children with adenoids and hypertrophied tonsils are much more likely to have an involvement of the middle ears in any condition causing a nasopharyngitis. Coughing, violent blowing of the nose at any time, and often the use of nasal douches or sprays are responsible for the initial infection in both adults and children.

Diving and surf bathing, where the nose and nasopharynx may be filled with water, are also frequently causes. In any case, where a column of water is introduced into the nasopharynx, the act of swallowing forces water instead of air through the eustachian tube into the middle ear. If the water carries bacteria from an infected nasopharynx, it is very probable that an infection of the middle ear will take place.

Therefore, whenever nasal douches are used, the patient should be instructed to keep the mouth stretched wide open (this effectually prevents swallowing) until the douche is completed and the patient has violently snuffed back through the nose and hawked out the water in the nasopharynx.

It is perfectly evident that this cannot be successfully practiced in children, and therefore the use of nasal douches becomes a dangerous procedure. Even adults, warned and alert, often make a mistake and swallow at the wrong time. I have seen so many serious infections of the middle ear from this cause, that for twenty years I have warned against the use of douches, ducks, cups, etc., where the volume of water introduced is sufficient to fill the nasopharynx. A medicine dropper, using a few drops of solution or a spray from an atomizer, is far safer, and even these should be followed by snuffing through and hawking the nasopharynx clear before swallowing or blowing the nose.

The same method of snuffing and hawking the nose and nasopharynx clear should be advised for all who immerse themselves in water by diving or surf bathing.

From whatever method the infection occurs, a violent inflammation in the middle ear is set up. This induces pain, usually a mild rise in temperature, and loss of hearing. On inspection, the ear drum is at first congested, a little later the luster and translucence disappear, the usual cone of light is lost, and, as the fluid gathers in the middle ear, the drum bulges. Pressure and inflammation may cause a necrosis of the epithelium of the drum. In the last stage before rupture, the drum membrane is either dull, beefy red, or dirty gray, and lusterless, with no evidence of the usual landmarks.

Treatment.—When seen in the very initial stage, while the drum is pink, has a luster and is not bulging, irrigation at one or two-hour intervals may be tried for a few hours, with sterile normal saline solution at a temperature of 105° or 106°, using a pint to a quart each time, and following by the instillation of warm adrenalin chlorid solution (1:1,000), allowing it to remain a few minutes and then draining out on a towel or pad of cotton.

At any other than this initial congested state, no time should be lost in making an incision in the drum membrane.

Myringotomy.—Incision of the drum membrane should always be done under a general anesthetic, because it can then be done slowly and precisely. At the same time it will save the patient from most excruciating pain.

Incision or puncture of the drum without an anesthetic is very cruel. Furthermore the patient can never be kept still. A sudden movement of the head may result in a puncture in the wrong place, a possible injury to the ossicles, or even a wounding of the labyrinth with resulting labyrinthitis, meningitis and death.

Ether or chloroform is far better than nitrous oxid gas, as the few additional minutes of recovery of the senses save the patient much agonizing pain. It is needless to say that the operation should be done with surgical cleanliness. The canal and auricle should be cleansed with a douche of 1:2,000 bichlorid of mercury solution, the knife and specula rendered aseptic by boiling.

The incision should always be along the posterior and inferior periphery of the drum membrane. An incision is always preferable to a puncture. I usually begin the incision at about "due south" on the circumference, carry it upward along the posterior periphery to and through Schrapnell's membrane, and outward on the canal at about "northeast," or "northwest" cutting through the periosteum in that part of the canal to the bone. A free incision of this kind gives better drainage and heals more quickly than a puncture. Moreover, if the initial incision is made in this way, a second incision will not be necessary. If such an incision does not afford sufficient drainage to arrest the progress of the inflammation, it is far wiser to consider drainage from behind (mastoidectomy) than to delay interference by a second or third myringotomy, as is often done.

If the granulations are so dense in the middle ear or the purulent discharge is so thick that a little more forcible irrigation or gentle pressure by means of a cotton swab does not relieve it and start the flow again, a second incision will be useless.

Following the incision, irrigations of a pint to a quart of a solution of boracic acid (a teaspoonful to a pint) at a temperature of 105° F. or 106° F., through a glass return flow tip (Lucae's) from a height of

one to two and a half feet, should be made every two hours by day and four hours by night, for the first twenty-four or forty-eight hours, until a free discharge of pus is established. It is well to bear in mind that these frequent irrigations are not intended to do more than wash out the canal and keep the incision from healing until the flow is established. After the second day, the intervals may be lengthened and finally stopped at the end of a week or ten days. The discharge usually stops and the incision heals in from ten to fourteen days. During the last days the discharge should have grown more and more scanty and finally stopped. A case that has not acted in this manner in the second week, but has rather kept up a profuse discharge, should be regarded with suspicion of a mastoid involvement even if no other symptom of a mastoiditis has appeared. The case which progresses to recovery and a healed incision within two weeks, as most of them do, will show little or no impairment of hearing after a month. Where the discharge persists without symptoms of mastoid involvement, the nose and nasopharynx should be examined carefully for obstructions, and these, if present, should be promptly removed in order to prevent the case from drifting into a chronic purulent ear or other complication. Where the incision has healed and there is a persistent loss of hearing, obstructions should be looked for and removed if present. Inflations of the ear at intervals of a few days should then be made until normal hearing is restored.

Mastoiditis.—An extension of infection from the middle ear to the cells of the mastoid process takes place in a large percentage of cases of middle-ear abscess. The route through the attic to the aditus ad antrum is open, and probably involvement, to that extent, takes place in nearly every case where the middle ear is infected. Where the mastoid cells are large and freely communicate, infection of all the cells is not uncommon.

If this view is correct, and I believe it is held by nearly all who have had a large experience in otology, it follows that a very large percentage of cases of mastoiditis recover without a mastoid operation. Indeed I feel certain that it would not be far out of the way to say that 50 per cent of all cases, with adequate drainage through the drum membrane and with rest in bed, would recover without any further operation.

On the other hand, it would be unfair to say that one could safely allow 50 per cent of the cases with mastoiditis to go without further operation, inasmuch as too large a number of them might progress rapidly to serious and often fatal complications.

The question then arises, Which cases are definitely operative?

The typical cases present some or all of the following symptoms:

A Profuse, Purulent Discharge from the Middle Ear.—There is far too large an amount to be coming from as small a cavity as the middle ear itself. In such a case, it is very evident that other cells in the mastoid

must be pushing their purulent contents through the aditus to the middle ear and out into the auditory canal. If a purulent discharge is carefully mopped up with pledgets of cotton down to the drum, and in a few minutes the canal fills again, it is perfectly obvious that this excessive amount of pus is being manufactured in the mastoid cells.

Tenderness Over the Mastoid Process.—This means an inflammatory process in the cells, which has extended to the periosteum. It usually appears first over the mastoid antrum, that is, directly behind the external auditory canal, close to the auricle. When this is present, inspection of the auditory canal shows a swelling posteriorly and superiorly, close up to the drum membrane. This is due to the fact that the periosteum over the antrum in this position has only a very thin shell of bone between it and the inflamed cavity.

The very tip of the mastoid process is another point which is often very tender to pressure early in a mastoid involvement. In such cases, the tip cell is probably large and the cortex thin. Diminishing tenderness following a myringotomy is favorable; increasing tenderness is very unfavorable.

Pain.—A dull, aching, throbbing pain in the mastoid is very significant. This is usually proportionate to the freedom of the intercommunicating cells. Narrow communications, or isolated cells which are infected, necessarily mean pus under pressure, and this causes great pain. On the other hand, extensive involvement may be quite painless if all the cells have free communication. Where the flow of pus is impeded or stopped by excessive granulations in the middle ear or antrum, or by narrow communications between the cells, there is likely to be excessive pain and increasing tenderness. When the cortex is very thick, there may never be any tenderness to pressure, even with marked involvement. In such a case, severe pain with sudden stoppage of the flow of pus, without tenderness, may be very significant.

Swelling.—In infants under two years of age, postauricular subperiosteal swelling is liable to be an early sign of mastoid involvement. It is more unusual as the age increases and after adolescence is not seen often, except in neglected cases in which there is marked necrosis of bone.

Temperature.—It may not be said that a rise in temperature can be looked upon as a diagnostic sign in mastoiditis. Frequently, both in adults and children, well-advanced cases of mastoiditis will be found to have a normal temperature. Where fever is present, it is more likely to be the result of the concomitant disease than of the ear complication. I have often, for purposes of demonstration of this point, exhibited companion charts which were identical—showing high, moderate, fluctuating and normal temperature—in which one suffered with a complication of middle-ear abscess, mastoiditis, or sinus-thrombosis, while the other had no ear complications whatsoever. The point is that the absence of tem-

perature variations must not be used against a diagnosis of mastoiditis in the presence of characteristic signs; and the presence of temperature variations must be looked upon either as a manifestation of concomitant disease—tonsillitis, adenitis, sinusitis, pneumonia, etc.—or as a manifestation of some extension of infection from the mastoid to adjacent structures—epidural perisinus abscess, septic sinus-thrombosis, meningitis, etc.

X-ray.—A radiograph of the mastoid, made and interpreted by an expert, will often clear up a doubtful diagnosis of mastoiditis. Poor work, either in the radiograph or the interpretation of it, should be discarded in the presence of definite clinical symptoms.

Treatment.—Any case showing the classical symptoms here outlined is much safer operated than expectantly treated. Whenever all these symptoms are not present, I should say that any of the following would be sufficient indication to warrant operative interference:

1. If mastoid tenderness, which was present at the time of myringotomy, was increasing rather than diminishing, or had not entirely disappeared in 48 hours.
2. If mastoid tenderness appeared after myringotomy had been done, establishing free drainage from the tympanum.
3. If temperature, otherwise unaccounted for (concomitant disease), did not subside in twenty-four hours, or appeared after the myringotomy.
4. If a blood count showed a leukocytosis and increased polymorphonuclear percentage which could not be definitely accounted for by concomitant disease (tonsillitis, adenitis, pneumonia).
5. If there was not a rapid lessening of the discharge after the first week or ten days, and a radiograph showed the mastoid cells cloudy or broken down.

There is another point of view which must not be overlooked, namely, a mastoid, skillfully operated early—before any complication has developed—has a practically certain chance of quick recovery with restoration of normal hearing. A mastoid which is being expectantly treated may at any time "throw consternation into camp" by some untoward complication which makes recovery precarious. If operated late, even without complications, recovery will be longer and the hearing will almost certainly be impaired.

Epidural or Perisinus Abscess.—A small dehiscence in the inner plate of the mastoid over the middle fossa, the cerebellar fossa, or along the course of the lateral sinus may allow a leakage of infection through to the dura when a mastoiditis is present. Protecting granulations are thrown out from the dura and a localized abscess between the dura and cranium is formed. Deep-seated pulsating pain in that region and marked tenderness to deep pressure over a limited area are usually present. High

temperature may be present, but it is not unusual to find such a condition without rise of temperature.

Treatment.—The treatment consists of mastoidectomy and craniotomy, which uncovers the abscess to normal dura. The protecting granulations over dura or sinus wall should not be curetted, as they form the best protection against extension of infection into the blood-stream, when over the lateral sinus; or into the meninges, when over the dura of the middle or cerebellar fossæ.

Septic Lateral Sinus-thrombosis.—Infection extending from a mastoid abscess may involve the lateral sinus wall anywhere from the jugular bulb to an inch behind the knee. This extension may take place directly, through dehiscences in the inner plate, by necrosis of the wall, or by phlebitis of the small veins leading from the mastoid to the sinus walls. An inflammation of the sinus wall is started up. A parietal thrombus is formed at this point. This may remain small or build up until the lumen of the sinus is completely occluded. I have seen such a clot extend backward to the torcular herophili and downward to the innominate vein. Usually the clot does not completely occlude the vein. In the course of a few days, the clot may begin to disintegrate, and particles may then be carried to the spleen, lungs, kidneys, liver, joints, etc., setting up a general pyemia. In the earlier stages, the wash of the blood-stream over the forming thrombus may carry enough bacteria into the circulation to produce a violent septicemia. In typical cases, at the very outset when the vein wall becomes infected, a chill or chilly sensation is followed by a rapid rise in temperature to 103° or 105° F. This is followed by a profuse perspiration and a sudden drop of temperature in a few hours to normal or subnormal. In the early stages, these vacillations of temperature occur about once in twenty-four hours. Later on, the intervals may be as short as twelve hours. In the afebrile hours the patient at first is comfortable; if a child, he may be happy and playing with toys and even have a good appetite. Later on, typical septic symptoms are present. A blood count taken at this time will show a moderately high white cell count, say from 12,000 to 20,000, with 70 to 80 per cent of polynuclear cells. In the later stages the white count may rise to from 20,000 to 30,000, and the polynuclear percentage up to from 80 to 90 per cent. Higher counts than this, while they may be present in septic thrombosis, are in themselves more typical of meningitis or pneumonia or erysipelas. It is well to bear this in mind where other symptoms are atypical and one is trying to differentiate. A blood culture frequently shows a bacteremia.

It must be remembered, however, that non-hemolytic bacteria are rapidly disposed of by the blood-stream; a specimen taken at any time, which does not show the presence of bacteria, does not certainly demonstrate

that there has not been a bacteremia at other times. One is more likely to get a positive culture from blood taken during the febrile stage. The pulse is irregular, rapid and bounding. The patient looks "septic," increasing in pallor from day to day. During the first week, the patient may remain well nourished and retain a good appetite; in the later stages, emaciation is rapid.

There is usually a deep-seated pain over the sinus region, and maybe tenderness to pressure. There may be also tenderness along the course of the jugular in the neck, and the cervical glands on that side may be swollen and tender.

The typical cases are easily recognized. Atypical cases are not uncommon. Occasionally an erysipelas may be developing, which, until it makes its appearance around the wound, may in its febrile movement prove very puzzling.

A continuous high temperature with drops of only one or two degrees is often misleading, as it may be due to a sinus involvement or a latent pneumonia. This is doubly misleading at times where a positive blood culture may be obtained from either disease. These doubtful cases are always very trying, inasmuch as the operation in itself is altogether too serious a proposition to undertake without a positive diagnosis, and yet, on the other hand, we know that early operation offers a much greater hope of successful outcome than a late one. It is probable that a skillful operation in the first week of sinus-thrombosis will save 75 per cent of all cases, while the same operation in the second week will not save more than 25 per cent. Therefore it behooves one in a doubtful case to bring every effort to bear on an early diagnosis.

Treatment.—Treatment consists of isolation of the septic focus, so that infection cannot be carried into the blood-stream. This means the tying of and incision of the jugular in the neck, and plugging the lateral sinus beyond the clot, somewhere between the knee and the torcular herophili. The sinus wall is then slit or dissected away from the plug to the jugular bulb, and the septic clot removed.

Chronic Suppurative Otitis.—Chronic discharging ears usually result from neglect of acute cases. Failure to drain an acute case leads to the formation of granulations in the attic, aditus and mastoid antrum. The discharge continues for months or years. Eventually a necrosis of the ossicles in the middle ear takes place. In the very chronic cases there is also necrosis of bone in the attic, aditus, or antrum. This may extend to the mastoid cells, if present. Very often these chronic cases develop in the types of mastoid in which there is a sclerotic mastoid (infantile type) with no cells except the antrum. The odor from the discharge is very foul where necrosis is present. In many cases the attic and antrum are filled with masses of cholesteatoma which gradually erode the sur-

rounding bone, occasionally invading the cranial fossæ (cerebral or cerebellar) or the labyrinth in the petrous portion of the mastoid.

Treatment.—These cases, when seen, have usually gone the round of ineffectual efforts to relieve them by the use of douches, alcohol and boracic acid drops, methylene-blue, silver nitrate, hydrogen, peroxid, etc.

Occasionally one sees a case where necrosis has not occurred, in which careful clearing out of adenoids and tonsils or some nasal obstruction, followed by careful douching of the ear and application of alcohol and boracic acid, may succeed in drying up the discharge. Where necrosis is present, or where the effort as described has failed, nothing is left but a *radical mastoid operation.*

This operation converts the tympanum, attic and mastoid antrum into one smooth rounded excavation and closes off the eustachian tube, leaving a dry cavity. Such an operation is performed more on account of the surgical menace from the chronic suppuration than on account of the loss of hearing. The hearing may be a little better or a little worse after the operation, but the danger to the patient's life and the annoyance of a constant foul discharge from the ear will have been eradicated.

Acute Labyrinthitis.—Extension of an inflammatory process into the labyrinth is manifested by a violent vertigo, loud tinnitus and vomiting. On inspection of the eyes, a rapid oscillation of the eyeball will be found to be present. There will be a fast movement in one direction and a slow movement in the other. This will be from side to side or in a clockwise or contraclockwise direction. Observation in which direction the slow and fast movement takes place should be made, as it will be of great value to the specialist in determining the nature of the lesion.

The vomiting, which will be at short intervals at the onset, will gradually stop in twenty-four hours. The vertigo will be marked for about seventy-two hours. It can be brought out after this by special efforts.

The great danger in acute labyrinthitis is that it may lead rapidly to a meningitis. There is much more likelihood of this in very acute suppurations than in chronic ones, where there have been many slight attacks of vertigo before the violent one. This is due to the fact that in the acute case there may not have been time enough for the blocking off of the aquæductus cochleæ, which has a direct communication with the subarachnoid space, and therefore a direct tract of infection to the meninges is afforded. In the chronic cases, this is blocked off and, although the function of the ear may be completely destroyed, the acute danger of meningitis is lessened.

Treatment.—The question of treatment of labyrinthine suppurations is still sub judice and should be left to the judgment of the best available specialist on its own merits. If the observations on the eye movements have been carefully noted they will be of great service in helping him to determine the best course to follow. To discuss the pros and cons of the

question would require too much space and would be wearisome to those who may never see a case in a long practice.

Abscess of the Cerebrum or Cerebellum.—These may occur in the course of acute or chronic purulent otitis. The discussion of the whole subject is too great for this short article. Modern works on otology should be consulted for the symptomatology and treatment.

DISEASES OF THE SKIN

CHAPTER XXIX

TREATMENT OF SKIN DISEASES

H. H. Hazen

Technic and Formulary.—The treatment of skin diseases is particularly satisfying inasmuch as it is extremely easy to tell precisely what is being accomplished. In treating diseases of the skin it is not necessary to employ a great number of drugs, for the intelligent use of a few is preferable to the haphazard use of many. In some instances local treatment alone will suffice, but in many other instances it is essential to employ internal treatment as well. There is no danger in "curing an eruption too soon" or in "driving it in."

Under general treatment must be considered the use of a few medicines, bacterins and non-specific protein therapy; while under local treatment must be considered a few drugs, the X-ray, radium, phototherapy, electrolysis and carbon dioxide snow.

Drugs.—One drug which is usually used by general practitioners in almost all diseases of the skin is arsenic in some form. The skilled dermatologist but rarely employs this drug, reserving its use for acne and a few of the chronic diseases where there is some infiltration of the skin. It should always be remembered that its long-continued use causes the production of keratoses. Calcium sulphid in suppurative processes of the skin is of doubtful value. Quinin is useful in certain exfoliating dermatoses and possibly also in pemphigus.

Bacterins.—Bacterins are considerably used in acne and in furunculosis, but not nearly so much as formerly. The same rules apply to their application in skin diseases as in other conditions.

Non-specific Protein Therapy.—Non-specific protein therapy covers autoserum therapy, the intravenous use of bacterins and the intramuscular injection of milk, whole blood or various other proteins.

Autoserum Therapy.—Autoserum therapy is probably the mildest of these treatments. From 30 to 50 c.c. of blood are drawn from a vein, centrifuged to separate the formed elements, and the serum reinjected, all under aseptic conditions. This mode of treatment has real merit in psoriasis and dermatitis herpetiformis.

The intravenous use of various bacterins, notably the colon and typhoid organisms, usually causes a marked protein shock and may be useful in aggravated cases of psoriasis and dermatitis herpetiformis.

The intramuscular use of other proteins is probably not necessary if one is familiar with the methods just mentioned.

Local Treatment.—Local treatment is nearly always employed in skin diseases.

Baths.—Baths are employed for several purposes, to cleanse the skin, to stimulate it, at times for soothing purposes, and more rarely for antiseptic purposes. Water is very irritating in certain of the acute dermatoses, but a normal saline solution can frequently be used. This can be made conveniently by adding a flat teaspoonful of salt to each pint of water. One of the best soothing baths consists of from two to five pounds of starch (amylum) to thirty gallons of water.

Detergents.—Detergents are used to remove grease and scales from the skin. Among those in common use are water, normal saline solution, olive oil, and cream or top milk.

Emollients.—Emollients are soothing and protective applications. In practically all of the acute inflammatory dermatoses not of pyogenic origin, it is necessary to employ one of these. Powders and lotions are usually much better than ointments. Among the powders must be mentioned talc, zinc stearate, boric acid, calomel, bismuth, starch, and lycopodium. An excellent lotion is the well-known calamine preparation:

℞

Pulverized calamine	ʒ iss
Glycerini	
Phenol,	āā ♏ xv
Liquor calcis, q. s. ad	ʒ vi

This is to be employed freely as one of the chief effects is mechanical protection. As this lotion is very drying it is well to apply olive oil once a day. In order to overcome the drying effect Pusey has suggested the use of a calamine liniment which has the following formula:

℞

Powdered tragacanth	ʒ i
Phenol	
Glycerini,	āā ♏ x
Calamine	ʒ ii
Olive oil	ʒ iv
Water, q. s. ad	o i

Antipruritics.—Antipruritics are indicated to stop itching. Among the most useful are carbolic acid, menthol, thymol, tar, oil of cade, and salicylic acid. The X-ray is also extremely useful and at times the same may be said of the ultraviolet ray.

Analgesics.—The drugs used to stop pain are cocain, or one of its derivatives, carbolic acid, orthoform and anesthesin.

Stimulants.—Stimulants are used to cause an increased blood supply and are chiefly employed in chronic inflammatory dermatoses. Those generally employed are tar, oil of cade, sulphur, salicylic acid, resorcin, mercurial salts, balsam of Peru, chrysarobin, iodin and some of the silver salts. The X-ray and the ultraviolet ray are also much used.

Antiseptics.—Antiseptics are applied to the skin for the purpose of destroying microörganisms. The following drugs are of value, generally in ointment form: ammoniated mercury, yellow oxid of mercury, bichlorid of mercury, sulphur, salicylic acid, resorcin, boric acid, carbolic acid, tar, iodin, silver nitrate and argyrol. The ultraviolet ray is also of value in certain cases.

Caustics.—Caustics cause local destruction of tissue. Those usually employed are silver nitrate, the mineral acids, trichloracetic acid, arsenious acid, pyrogallol and caustic potash. Carbon dioxide snow, the actual cautery, and fulguration are also much used.

Parasiticides.—Parasiticides are used to kill various animal invaders. The most useful are sulphur, balsam of Peru and naphthol.

Lotions.—Lotions are liquid mixtures usually made with water or alcohol as the menstruum. Plain water is frequently used, but lime water or rose water may be substituted. In the place of alcohol a small or large proportion of bay-rum may be employed. Lotions seem to be rather more efficacious than are powders, and not irritating as are ointments, hence are frequently employed in the acute inflammatory dermatoses. They are more pleasant than greasy applications. Glycerin is often added to them in order to avoid the dryness of the skin that so often follows their use. If a lotion is desired to exert a protective action for any length of time, a little glycerin and a little tragacanth are added, about two to three grains to the ounce. When it is desired to increase the drying effect, alcohol may be substituted for some of the water; this is especially desirable in cases of itching. The following lotions are commonly employed:

Normal salt solution as a non-irritating wash.
Boric acid in concentrated solution.
Calamine lotion, already described.

Solution of aluminum acetate (liquor burrowii), used chiefly as a wet dressing for acute inflammatory disorders:

℞

Alum. acet.	ʒ i
Acidi borici	ʒ iss
Resorcin	ʒ i
Aquae, q. s.	ʒ xii

Wet Dressings.—Wet dressings are used when it is desired to keep the skin constantly in contact with medication. Gauze should be soaked with a desired lotion and a waterproof covering of oiled silk put over this. If a soothing effect is desired it is important to allow evaporation to take place.

Ointments.—Ointments are made up with fat as a base. Those commonly employed are cold cream, lanolin, vaselin, lard, white and yellow wax and cocoa butter. The last two are added to give stiffness, while glycerin, liquid vaselin or some oil may be added to soften. Cold cream should not be used with either mercury or resorcin on account of the marked color changes that may occur. Occasionally it may become rancid. Lanolin has the advantage of being miscible with water. Vaselin will occasionally prove irritating. Practically any drug may be incorporated with such bases.

Pastes.—Pastes are ointment bases in which a powder has been incorporated to add stiffness. They tend to absorb secretions and hence may be used upon weeping surfaces. Lassar's paste is the type upon which most are constructed. A useful modification of this is:

℞

Zinci oxidi	ʒ i
Amyli	ʒ iiss
Petrolati, q. s.	ʒ i

Plasters.—Plasters are adhesive preparations for use when it is wished to apply a small amount of active remedy to a limited surface. A strong salicylic plaster is especially useful in the treatment of such conditions as corns.

Fixed Protective Applications.—These are applied while in liquid form and upon drying leave a fixed residue upon the skin. The compound tincture of benzoin may be used as a sort of varnish. Flexible collodion may be used as a base for salicylic acid, etc. Unna's zinc oxid jelly often makes an excellent protection for an acutely inflamed surface. A good formula for this is:

℞

Zinci oxidi	℥ i
Gelatin	℥ ii
Glycerini	℥ iii
Aquae	℥ iv

Powders.—Powders give a certain amount of protection to the surface. They absorb some moisture and at the same time give an increased evaporating surface. Among the most commonly used are zinc oxid, bismuth subnitrate, talcum, kaolin, zinc stearate, magnesium carbonate, prepared chalk, starch, boric acid and lycopodium.

Roentgen Ray Treatment.—The Roentgen ray is unquestionably the most useful single form of therapeutic agent at the disposal of the dermatologist to-day. The best type of machine is an interruptless transformer, capable of backing up a 9-inch spark gap, with Coolidge tube equipment. The dosage from such a machine can be accurately determined by MacKee's arithmetical formula. From extensive experience the writer can positively state that this method of measuring doses is uniformly reliable, provided that all of the units are correctly measured.

The X-rays exert certain definite effects on the tissues:

1. They cause atrophy of the glands and of the hair follicles.
2. They relieve pain and itching.
3. In small doses they possibly have a stimulating effect upon cell growth.
4. In large doses they will destroy any tissue with which they come in contact, but they have a selective action, first destroying cells of lowered resistance, as cancer cells.

Hence they have the following uses in dermatology:

1. To remove hairs; this is not advisable in hypertrichiasis, but is the best method of treatment in sycosis, ring-worm of the scalp, etc.
2. To cause atrophy of the glands, as in acne, rosacea, hyperidrosis, and certain other conditions.
3. To destroy pathologic tissues, such as cancers, warts, etc.
4. To give an anodyne effect.
5. To stimulate the skin, as in lichen planus and certain forms of so-called eczema.

In the employment of this agent several most important facts must be remembered:

1. Even one erythema dose may cause a later development of permanent telangiectasias.
2. The parts of the patient which are not to be directly treated must be carefully protected.
3. The operator must also be thoroughly protected.
4. The skin of children and of blonds is more susceptible than that of ordinary adults.
5. The skin of the face and of the joints reacts more readily than other portions of the body.
6. Irritating preparations must never be used to the parts exposed to radiation, as a burn may follow.
7. With the exceptions just mentioned, practically all skins will react in the same way. Were this not so, X-ray therapy could not be employed with any degree of safety.

A comparison of *X-ray* and *radium* from the dermatological standpoint must be made.

1. With the X-ray wide areas can be exposed in a short time. This is not true of radium unless enormous amounts of it are at the disposal of the physician.
2. Roentgen-ray treatment can ordinarily be given very much more rapidly than can radium treatment.
3. Radium can only be standardized by biological tests, and it is necessary to know the erythema dose of each bit of radium that is employed.
4. With the Roentgen ray the dosage is always readily determined.
5. Radium can more readily be used in the body cavities.
6. Radium is superior in the treatment of leukoplakia and of most nevi.
7. In general the two agents work in precisely the same way. There is the same danger from large doses.
8. It is difficult to protect from the gamma rays of radium. They are constantly being emanated and will penetrate 10 cm. of lead.
9. The radium worker must be extremely careful not to finger his apparatus and this is often technically difficult.
10. The cost of a sufficient quantity of radium to do much work is considerably greater than that of the Roentgen ray apparatus.

The expert operator can accomplish with the X-ray anything that can be accomplished with radium except in certain forms of nevi and possibly leukoplakia. Radium is technically more convenient to use within the mouth or ear.

Radium.—Radium gives off three varieties of rays: the alpha, beta and gamma. The alpha rays are absorbed by almost any interposed substance; the beta rays require 5 mm. of lead to absorb them; while the gamma rays will pass through 10 cm. of lead. For therapeutic purposes either plaques or needles may be employed.

The author is absolutely convinced that no one should employ radium in dermatological work unless he has had either special training or a previous knowledge of roentgenology. The problems of filtration, distance and dosage are traps into which the unwary can readily fall.

Phototherapy.—This is usually applied by an ultraviolet lamp. These lamps are made by a number of manufacturing houses and may be either air cooled or water cooled. They are mercury-vapor lamps and are prone to lose effectiveness in a year or two. Renewals are expensive. The chief uses of these lamps are for seborrheic conditions of the scalp, for acute infections of the skin, for vascular nevi, radiation telangiectasias and for lupus erythematosus. It is possible, but not proven, that these rays will stimulate the growth of hair. The machines are by no means

foolproof. Very uncomfortable burns may easily be produced and at times there may be pigmentation that will last for many months. To produce any results it is necessary to produce an uncomfortable erythema.

Fulguration.—This consists of the application of a long spark for the destruction of diseased tissue. A very high frequency for this is less painful. There is no reason to believe this method to be more useful than the actual cautery.

The Electric Cautery.—The electric cautery is extremely useful in the treatment of warts, resistant cancers and all varieties of small growths. A local or general anesthetic is always necessary.

Ionization Therapy.—This consists of driving various substances into the tissues by means of the galvanic current. Practically it has proved a failure.

Electrolysis.—Electrolysis is for the destruction of tissue by means of the current given off by the negative pole of a galvanic battery. Ordinarily about 1 ma. should be employed. This is the only method for the removal of superfluous hair, and it is very efficacious for many small growths such as moles, flat warts and spider nevi.

Carbon Dioxide Snow.—Carbon dioxide snow can be collected from the ordinary commercial cylinder by simply wrapping a piece of chamois about the outlet, or by means of a special device sold for the purpose. The snow is chiefly used for various types of nevi and for lupus erythematosus. It should never be employed for skin cancer as the action is not sufficiently deep.

DISEASES DUE TO EXTERNAL IRRITATION

Certain of the common skin diseases are considered under other chapters. Burns are dealt with in the chapter on Minor Surgery, and many of the diseases due to chemical irritation are considered in the chapter on Occupational Dermatoses.

Callosity.—A callosity is a localized, flat thickening of the horny layer of the skin, and is a pure defense reaction against continued friction and pressure.

The commonest site for painful lesions is on the soles under the anterior arch; and they are almost invariably due to flattening of the arches. Thus the problem of treating the disease is frequently an orthopedic one. However, much comfort may be given by placing a ring of some soft substance such as felt around the edges so as to remove pressure. Paring down the lesions either with a knife or with pumice stone is generally resorted to. The use of a strong salicylic acid plaster, or painting with 1 dram of salicylic acid to the ounce of flexible collodion, will frequently facilitate removal.

Corn.—A corn is a peg-shaped hypertrophy of the horny layer of the skin, with the apex downward, and is a defense reaction against pressure and friction from badly fitting shoes. A corn differs from a callosity in its smaller size and its conical shape. The essentials of treatment for the ordinary hard corn are the same as for a callosity. A good chiropodist can often remove a corn so that there will be no further trouble for several months, but from the number of warts which are seen after such treatment it is an obvious fact that chiropodists frequently do not sterilize their instruments.

The *"soft corn"* is situated between the toes and upon the sides of one of them, and its softness is believed to be due to a lymph channel running up through the center of the lesion. A soft corn is probably most satisfactorily treated with either the X-ray or radium, an erythema dose being given. It can also be treated by injecting cocain and by excising with the electric cautery. While the toe is made sore for two weeks, the permanent result is excellent.

Miliaria.—Miliaria, or prickly heat, is an acute disease of the sweat ducts, due to excessive perspiration. Intensive heat during the summer, working in artificial heat, wearing too heavy clothing, and the drinking of alcoholic beverages may be responsible.

An attempt should be made to keep the patient cool and to stop any possible indulgence in alcohol. The surface of the body can often be cooled by the application of an insoluble dusting powder. Alcohol lotions are often useful, one containing 15 grains of menthol to 6 ounces of alcohol often being especially grateful. Absolute cleanliness is of the utmost importance.

Frost-bite.—Chilblains, or frost bite, are due to cold, especially to moist cold, and to any impairment of the circulation, to too tight clothing or shoes, or to a constrained position. Many of the cases of trench foot were simply marked examples of this condition. Three stages can be recognized: a persistent hyperemia, vesicle formation, and some loss of tissue.

The disease can often be prevented by wearing wool stockings, loose clothing and keeping the feet dry. Once the condition has appeared, wool socks are most uncomfortable, and silk or cotton must be worn next to the skin. During this stage much comfort is often given by a dressing of cataplasma kaolini. In cases of vesiculation, a mild antiseptic dressing should be employed.

Solar Erythema.—Solar erythema, or sunburn, is due entirely to too long an exposure to the sun, the rays from the blue end of the spectrum being responsible. This condition can be satisfactorily treated by calamine liniment, or even cold cream.

Freckles.—Pigment formation, either localized to small areas, as in freckles, or generalized, as in tanning, is a defensive act on the part of

the body, chiefly against light. Persons with sandy hair and a rather yellowish skin are more susceptible than blonds. The new pigment is located in the basal layer of the rete.

Treatment is unsatisfactory and it is best to let freckles alone. If removed during the summer they are sure to return. The object of treatment is to remove the upper layer of the epidermis, including the pigment, but great care must be exercised not to damage the corium. Most freckle removers contain bichlorid of mercury, usually in the strength of from 2 to 4 grains to the ounce of water. This can be daubed on several times a day until peeling is produced. A safer preparation is an ointment consisting of at least 1 dram of salicylic acid to the ounce of vaselin or cold cream. This should be applied rather thickly at night.

Intertrigo.—Intertrigo, or chafing, is a hyperemia of the skin, sometimes associated with maceration, occurring between opposed surfaces of the skin. It is still questionable whether this condition arises from friction, from maceration by moisture, from bacteria growing in an almost ideal culture medium, or from chemical irritation caused by decomposition of the sweat. Hot weather or long-continued exercise favors the occurrence of the disease in adults, while in infants it is usually due to neglect in changing the napkins. The condition is extremely superficial.

The first essential in treatment is absolute cleanliness, although soap should never be used as it is apt to be irritating. When the irritation is very acute, washing should be done with oil, starch water, or a normal saline solution. Gauze or cotton should be kept between the opposing surfaces, but must be changed as soon as moist. Wet napkins must never be left upon a child.

In rare instances where stools seem to be especially irritating, a careful study of the child's digestion must be made. Many clinicians give a little alkali by mouth, holding that there is an "acidity of the urine," a point by no means proved. Powders or lotions should be applied freely. In children when the skin becomes nearly normal it may be well to grease it with some bland ointment in order to protect against frequent stools.

Dermatitis Venenata.—Irritant dermatitis is an inflammatory condition of the skin, either acute or chronic, due to the direct local action of some irritating substance. The irritation is usually upon an exposed surface, but may spread to the covered areas. The reaction on the part of the skin naturally varies with the strength of the irritant, the time which it acts, and the condition of the skin at the time it is acting. Hence the lesions may range from a simple erythema to a marked pustular dermatitis.

In order to satisfactorily treat a case of this sort it is necessary to recognize the source of the irritation and to remove it. Among the com-

mon causes may be mentioned hair dyes, hair tonic, freckle removers, certain medicated creams and lotions, soaps containing free alkali, strongly medicated soap, too much soap and water, and alkali dust or water. Various articles of clothing are likewise frequently responsible, wool and fur being the two most common. Felt or feathers are rarely responsible. Certain articles of wool that are frequently forgotten as possible sources of irritation are blankets upon the beds, bathrobes and babies' caps or gloves.

Numerous plants in addition to the well-known poison ivy and primrose can exceptionally cause a dermatitis. Two of the most common of these are the ragweed and the ordinary tomato plant.

The great group of industrial dermatoses is considered in another chapter.

The *treatment* naturally depends upon recognizing the cause and removing it, but, in addition, much may be done to shorten the attack and to make the patient more comfortable. The use of the Roentgen ray in one-quarter unit doses, weekly, will frequently prove most effective. Any irritating substance should be kept from coming in contact with the skin. Soap is interdicted. Calamine lotion or Lassar paste, both already described, are useful locally.

Rhus Dermatitis.—Ivy poisoning is due to coming in contact with a portion of the poison ivy plant. The poison principle is "toxicodendrol," a non-volatile glucosid.

Ivy poisoning is often incorrectly treated. The fact that the poison is an oil soluble in alcohol is of the greatest importance, for alcoholic lotions must never be used in treatment as they are sure to spread the disease. However, for prophylactic purposes, a thorough washing with alcohol and a complete removal of the alcohol immediately after the exposure is an almost sure preventive. Many remedies are recommended, but the best treatment is probably washing with a strong solution of potassium permanganate, this drug oxidizing the poison. If there is much irritation, either calamine lotion or liniment may be applied to check the irritation. Inasmuch as the lotion will usually cause marked dryness, it is necessary to oil the skin with olive oil about three days after the application. The claim is made by some writers that patients can be immunized against the disease. However, the fact that a second attack can often occur within a week of the first would seem to indicate that immunity cannot always be conferred. Schamberg recommends the following method of immunization:

℞

Tinct. rhus toxicodendron	♏ xv
Rectified spirit	♏ lxxv
Syr. aurantii, q. s.	℥ iv

M.

The patient is instructed to take the mixture in half a glass of water after meals as follows:

SCHAMBERG'S DOSAGE FOR POISON IVY IMMUNIZATION

Breakfast	Lunch	Dinner
Drops	Drops	Drops
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21

When this dosage has been reached, the patient is to take 1 teaspoonful once a day, and this should be continued throughout the ivy season.

Primula Dermatitis.—Primrose dermatitis is very common and the symptoms are similar to those caused by poison ivy, although frequently less acute. In any case of vesicles frequently occurring upon the hands, this trouble must be suspected. The active principle is either a glucosid or an oleoresin. The treatment is practically that of poison ivy.

DISEASES DUE TO BACTERIAL INFECTION

Impetigo Contagiosa.—Impetigo contagiosa is a specific, acute, contagious disease caused by a streptococcus. It is one of the most common dermatoses. It is both auto-inocuable and contagious, and frequently occurs in epidemics. It may be contracted in a barber shop, but school is the most common place for the disease to be acquired. The vesicle is extremely superficial, being located just under the horny layer.

Treatment.—Crusts or overlying dead skin should be carefully removed so as to expose the base of the blisters. The base should then be painted with a fresh solution of silver nitrate, 20 grains to the ounce in strength. Usually two such applications on successive days will effect a cure. Many antiseptic ointments are used, one of the best being a dram of ammoniated mercury to the ounce of vaselin. Children suffering from impetigo should always be kept isolated until fresh blisters have ceased to form.

Pemphigus Neonatorum.—Pemphigus neonatorum is also known as pemphigus contagiosus, dermatitis exfoliativa neonatorum, Ritter's disease, and keratolysis neonatorum. It is an acute contagious disease caused by either a staphylococcus or a streptococcus. Newly born children are chiefly affected. The eruption consists of vesicles which usually appear

upon the face. They increase in size and number, and rupture speedily. The horny layer may peel off under pressure, but the infection is extremely superficial.

Treatment.—Any case of bullous or vesicular eruption originating in a maternity hospital should at once be isolated; no chances should be taken of an epidemic gaining a foothold. The general condition of the child demands attention, special emphasis being laid upon maintaining bodily heat. Proper nourishment must also be given. The use of any antiseptic is very dangerous if the lesions are widespread, but if there are only a few blisters the use of silver nitrate is proper as described under impetigo contagiosa. The skin should be bathed in a normal saline solution and all exposed exfoliating skin removed. Autogenous bacterins are strongly recommended, the initial dose being about five million organisms.

Furuncle.—A boil, or furuncle, is an acute localized abscess of the skin, usually caused by the Staphylococcus aureus, and beginning around a hair follicle.

In considering the etiology of boils, three factors must be considered. First is the resistance of the patient. It is well known that the debilitated are more apt to have abscesses than the healthy. Diabetes is a special predisposing factor. Marantic children are also very liable to have furunculosis. The second factor is that of chronic irritation. Boils are most common where the skin is subjected to friction, as upon the back of the neck where the collar rubs. Friction works in two ways, first by removing the horny layer of the skin and increasing the portals of entry, and second by mechanically rubbing in bacteria. Third, the specific cause of a boil is an infection with the staphylococcus, either the albus or the aureus.

Under ordinary circumstances fluctuation cannot be felt for five days, but in certain instances pointing may not occur for two or three weeks. This variety is usually called a "blind boil." There is always a tendency for neighboring follicles to become infected from the discharge.

The starting point is a hair follicle, sebaceous gland, or possibly a sweat gland or duct. At first there is a small area of pus formation that soon widens, the neighboring tissue being destroyed. This mass of destroyed tissue forms the "core." A boil is always walled in by a prophylactic membrane consisting of polymorphonuclear leukocytes, small round cells and fixed tissue cells, this being an attempt of the body to limit the spread of the infection.

Treatment.—Any underlying factors must have careful consideration. In all cases of recurring boils, the blood sugar should be estimated and if this be found high the carbohydrate intake should be reduced. The urine must always be tested for glucose. Any external irritant should be removed. Bowels should be kept open and plenty of water taken. The internal use of calcium sulphid is of doubtful value. Bacterins are of

no value in treating a single boil, but may be of much value where one after another appears. Autogenous bacterins are preferable to stock preparations. Boils are frequently poulticed with some hot moist substance such as cataplasma kaolini, with the idea of relieving pain and of "bringing them to a head" more rapidly, but poulticing may macerate the surrounding skin and render infection in the neighboring follicles probable.

If a boil is so located that a scar is of no importance, it should be incised on the third or fourth day under a local anesthetic. A boil should never be curetted, as this procedure breaks down the enveloping wall of leukocytes and may spread the infection. Where scarring is objectionable the best method of treatment is to allow the boil to come to a head, then make a very short incision with a fine knife and allow the boil to drain. A much smaller scar is thus produced.

Infectious Eczematoid Dermatitis.—Infectious eczematoid dermatitis —which is also called Engman's disease, pustular eczema, impetiginous eczema and staphylococcia—is an acute inflammatory disease of the skin, characterized by the occurrence of vesicular and small pustular lesions, and due to a staphylococcus infection. The disease somewhat resembles eczema, but there is less itching, usually some superficial pustules, and the draining lymph-nodes may be enlarged.

Treatment consists in thorough cleansing of the débris from the surface of the skin, and the application of some antiseptic. A 4 per cent solution of silver nitrate, a 15 to 25 per cent solution of argyrol, or a yellow oxid of mercury ointment, 12 grains to the ounce, are all good. The ultraviolet light is frequently useful. Should there be any vegetations in a case of long standing the X-ray may be used to reduce them.

Comedo.—A comedo or blackhead is a chronic infection of the sebaceous glands, due to a plug of dried sebaceous matter. The disease is usually seen in connection with acne, but may occur independently. Where there are many lesions the treatment is the same as for acne. Where there are but one or two lesions the offending gland can be destroyed with the electric needle.

Acne Vulgaris.—Acne is a chronic inflammatory infection of the sebaceous glands, characterized by blackheads, papules and pustules. It occurs only in connection with a greasy skin and almost invariably begins about the time of puberty, due to the increased activity of the sebaceous glands at that time. Any condition that lowers bodily resistance may favor its development; this is especially true of indigestion and constipation. Unquestionably the consumption of chocolate, or greasy food, or of an excessive amount of carbohydrates makes matters worse. It is probable that chlorosis and menstrual disturbances are much over-rated as causative factors. Diseased tonsils or teeth have absolutely nothing to do with the condition. The acne bacillus is probably responsible for many

of the papules and a staphylococcus for the pustules. The local use of cold cream is also a predisposing cause. Although acne is to all intents and purposes simply an abscess formation in the sebaceous gland, it may vary much in severity and in the resultant scarring.

Treatment.—In all instances the habits of the individual require a thorough search. Good hygienic living must be enforced. The bowels must be kept open and the diet should be plain but nutritious. Particularly must we exclude all greasy foods from the dietary. Candy, especially chocolates, must be prohibited. It is not at all infrequent to see a severe relapse following close upon indulgence in chocolate candy. Eating between meals is to be stopped. No pork, pastry, pickles or any article of food that is followed by an outbreak of acne lesions is to be permitted. Indigestion should be corrected.

Calcium sulphid is useless. Yeast is much more valuable to the yeast companies than to the patient. At times Fowler's solution is distinctly useful. This should be employed in the following manner: On the first day one drop should be given after each meal; on the second day a total of four drops should be taken, and an increase of one drop per day kept up until a total of twenty drops per diem is reached. This should then be discontinued for a week and then resumed, beginning with three drops a day as already outlined. Not more than three successive courses should be given.

Bacterins are much used. Staphylococcus bacterins, either autogenous or stock, generally fail. Acne bacterins not infrequently help for a time, but a relapse almost invariably occurs. Probably the best method of employing the bacterins is to begin with an initial dose of 15,000,000 and give injections from every five to eight days, increasing the dose about 20 per cent each time. Upon reaching the dosage of 100,000,000 the dose should be given only once in two weeks. Bacterins are but little used by skilled dermatologists.

The *local treatment* is of the utmost importance. The object of this is to render the skin as dry as possible, and to remove blackheads. The skin should be frequently washed with hot water and soap and a drying lotion employed. One of the best of these is the well-known alba lotio.

℞

Potas. sulphuret.	ʒ i
Zinci sulphat.	ʒ i
Aquae, q. s. ad	℥ iv

This lotion is made by dissolving the salts in separate portions of water and then mixing the two. It should be well rubbed into the affected areas after washing. Another useful lotion is one consisting of 40 grains of salicylic acid to 4 ounces of equal parts of alcohol and water. This

is simply dabbed over the face from two to four times a day. The blackheads can be expressed with a small hair pin, or a comedo remover.

The X-ray is a much more certain means of relief. Over 95 per cent of all cases can be cleared up by the proper use of this agent, although 25 per cent of them relapse later. The best method of employing the ray is to use one-quarter skin unit weekly. An erythema must be absolutely avoided. In ordinary circumstances from eight to ten treatments will cause an almost complete disappearance of the lesions. The advantages of this method are: almost complete assurance of relief; freedom from doing anything at home; and marked mental comfort. The disadvantages are: the treatment may temporarily tan or freckle; there may be some temporary dryness; and the first treatment may make the condition much worse for a few days.

The use of the ultraviolet light is by no means as certain as that of the X-ray, and the resultant erythema is extremely disagreeable to the patient. The ordinary high-frequency current is without value.

The Seborrheas.—It was formerly the custom to divide seborrheas of the scalp into two groups, the dry and the greasy. It is now recognized that there are at least four groups: (1) seborrhea capitis, where there is a simple oily condition of the scalp; (2) pityriasis simplex, or ordinary dry dandruff; (3) pityriasis steatoides, or greasy adherent dandruff; (4) seborrheic dermatitis, which is markedly inflammatory. All of these conditions are probably due to local infection. It is conceded that a seborrhea can probably never be entirely cured, but in most instances the condition can be much helped. At this point a word or two concerning the hygiéne of the scalp seems advisable.

Under ordinary circumstances a woman's hair should be washed about once in three weeks and a man's hair about once a week. Brushing will obviate the need for very frequent washings. Where the hair is very dry the frequent use of soap and water is harmful inasmuch as it removes the natural oil. Dry scalps should always be oiled with white petroleum oil, olive oil, cocoanut oil, or sweet almond oil after washing, the oil being applied to both the scalp and the hair. Singeing or permanent waving increases the dryness, and so do the hot-air driers.

A simple oily scalp has the following pathology. The sebaceous glands are enlarged and their mouths are frequently "corked" by greasy plugs. Simple washing with soap will remove these plugs and the scalp will become very oily from three to four days later. In such cases it is often better not to use soap and water but to dust orris root or fine corn meal into the scalp and to brush it out again, washing the scalp only when it becomes very dirty. Such a condition will frequently recover spontaneously. At times the ultraviolet lamp is useful. The rays should be used just strong enough to cause slight peeling.

Ordinary dry dandruff or sticky greasy dandruff are both treated the

same way. It is usually wise to use an ointment consisting of one dram each of precipitated sulphur and salicylic acid to sufficient white vaselin to make an ounce. This should be rubbed into the scalp from one to eighteen hours before washing. In the interval between washing the following prescription may be used:

℞

Hydrar. chlor. cor.	gr. i
Acid salicylici	ʒ i
Glycerini	♏ x
Aquae	℥ ii
Alcohol, q. s.	℥ vi

This should be applied at least three times a week and is best rubbed in with a soft toothbrush. It should not be allowed to run over the face, nor should it be rubbed in with the fingers, inasmuch as it may dry the ends of these very badly. The scalp should be washed frequently enough to keep it clean. The ultraviolet ray is often a great aid in combating both of these conditions.

Seborrheic dermatitis, either upon the scalp or body, is handled in much the same way, but the treatment must necessarily be more vigorous and it is usually necessary to use ointments daily over a period of from two to six weeks. When the inflammation has entirely disappeared, the use of the lotion mentioned above will generally prevent recurrence. The X-ray may be used upon the body in one-quarter skin unit doses at weekly intervals, and the ultraviolet ray will often much benefit the scalp. Again the scalp should be washed whenever dirty.

Tuberculosis of the Skin.—A number of dermatoses are due to direct infection with the tubercle bacillus. The most common of these are lupus vulgaris, tuberculosis verrucosa cutis and scrofuloderma. A number of other conditions are generally believed to be due either to the irritation produced by a very few tubercle bacilli or to their toxins. The most frequent is the papulonecrotic tuberculid. A question of considerable practical importance, both from the standpoint of prognosis and treatment, depends upon whether tuberculosis of the skin is to be considered as an hemotogenous infection or an external one. The opinion is gaining ground that in the majority of instances the infection is blood borne and that hence there is some other area of infection, usually one in the lungs or lymph-nodes. If this view is correct it is essential that cases of tuberculosis of the skin should be handled along the accepted lines, that is, given fresh air, rest and suitable food. The use of tuberculin has not been a great success in skin tuberculosis, whatever may be said of its therapeutic value in pulmonary tuberculosis.

Lupus Vulgaris.—Lupus vulgaris almost invariably begins before the age of sixteen. It is especially apt to arise upon the face so that some scarring is almost sure to occur. The spread of the disease is slow but

certain, although some lesions end spontaneously. The infection invariably reaches deep down into the corium, usually almost to the fatty layer. In certain instances there is a marked sclerosis of the entire corium, a condition that pathologically resembles the results produced by excessive X-ray or radium therapy.

In the very early cases where there is but one lesion, a broad excision yields excellent results. The same may be said of the actual cautery. The X-ray or radium can likewise produce a cure. Owing to the depth of the lesion it is probably wise to use a filter of at least 1 mm. of aluminum, and to employ sufficient radiation to give an erythema. Several treatments must be used. The Finsen light treatment has given excellent results in the hands of its originator and the cosmetic results are usually splendid. The ultraviolet lamps now on the market in America are not nearly so effective as the original apparatus.

The extensive cases which do not show sclerosis are best handled by means of the X-ray, the actual cautery or the curet and fulguration. The sclerotic cases must never be treated by radiation as a third-degree burn is almost certain, even with small doses. At times radiation may be justifiable just along a spreading edge, but never into any other area. Operative interference is likewise almost impossible, as healing is very slow. Taken all in all these cases are extremely difficult to handle even by the most expert.

Tuberculosis Verrucosa Cutis.—This disease is a chronic infection of the skin characterized by warty outgrowths. The lesions are particularly frequent upon the hands, where they are spoken of as anatomic tubercles. In the small lesions only the superficial layers of the skin are invaded, but in old-standing cases the entire corium may be involved.

The treatment is practically identical with that of lupus vulgaris. In the small lesions about the hands the X-ray will often work very well.

Scrofuloderma.—Scrofuloderma is tuberculosis of the skin due to extension from a tuberculous gland. The preferable form of treatment is unquestionably the use of well-filtered X-ray. This will benefit both the skin and the underlying lymph-nodes.

Papulonecrotic Tuberculid.—This little lesion, which is also known as small pustular scrofuloderm, folliclis, acnitis, acne agminata and acne cachecticorum, is a small papule with a necrotic center. It is most frequently seen in children and is rather infrequent in persons past thirty-five. The lesions are self-limited and usually disappear in from four to six weeks, but leave a small pitted scar. In the case of larger lesions an erythema dose of unfiltered X-ray will usually cause disappearance within two weeks. Radium should do the same. The scarring from the use of radiation is much less than that produced by cauterization.[1]

[1] In infancy the recognition of these lesions is very important as they frequently clinch the diagnosis of acute miliary tuberculosis.—Editor.

Erythema Nodosum.—Erythema nodosum is an acute inflammatory disease of the skin caused by a specific microörganism and characterized by subcutaneous nodules. It is associated with general disturbances, such as headache, malaise, articular and intestinal pains and fever. There may be a mild nephritis. The constitutional symptoms usually begin to diminish by the end of the third day and disappear by the end of a week, while the skin lesions last from two to four weeks.

Treatment.—The disease is distinctly a self-limited one. At the onset the patient should be kept quiet, the bowels opened and plenty of water given. Acetylsalicylic acid will usually control the pain. If the cutaneous lesions are very tender they may require artificial protection, felt or cotton being used around the edges so as to absorb trauma.

Tinea Tonsurans.—Ring-worm of the scalp is a contagious disease and may be caused by several varieties of ring-worm organism. It is characterized by the formation of partly bald, usually scaly areas which contain short broken hairs. The interior of these hairs as well as their sheaths simply swarm with parasites. Children past puberty are not affected. In one variety, the so-called kerion, there is pus formation in the corium, this pus being due directly to the ring-worm parasite. The disease is extremely contagious and frequently will affect many children either in the home or in the school. In addition the disease may be acquired from domestic animals, especially cats, dogs and cattle.

Treatment.—There are two ways of attacking the problem of treatment. One is by the persistent use of antiseptic ointments, and the second by epilation with the Roentgen ray. An antiseptic ointment consisting of 1 dram of salicylic acid, ½ dram of ammoniated mercury and enough white vaselin to make an ounce is as good as any other. This ointment should be rubbed into the scalp twice a day and a cap should be worn day and night. An occasional case is cured by some six months of steady treatment.

Where but one or two very small areas are affected, all hairs can be pulled with a pair of epilating forceps and an antiseptic ointment used.

In the vast majority of cases, however, there is usually so much involvement by the time a physician is consulted that hand epilation is clearly impossible. In these cases the entire scalp should be epilated by means of the X-ray. This treatment requires special technic, but it is absolutely satisfactory. MacKee reports on over 1,000 cases treated without a single bad result, and the author has treated over 300 in an equally successful manner. After the X-ray treatment has been given, an ointment consisting of 12 grains of yellow oxid of mercury to an ounce of white vaselin is usually employed for about one month. The hair falls between the fourteenth and twenty-third day, and during this period a cap should be worn lest stray hairs infect others. New hair returns in from six to twelve weeks after the falling. The new hair is not always of exactly the same

texture or color as the original, an excellent argument against partial epilation.

Tinea Circinata.—Ring-worm of the body is a contagious disease caused by some species of ring-worm parasite and characterized by superficial areas of inflammation. It is acquired in the same way as tinea tonsurans.

Treatment.—Almost any antiseptic will cause its disappearance within a week. In the more stubborn cases an ointment consisting of 20 grains of sodium carbonate and 40 grains of ammoniated mercury to the ounce will often work like magic. Another excellent prescription is Whitfield's ointment, consisting of ½ dram each of benzoic acid and salicylic acid to the ounce.

Tinea of the Hands and Feet.—Within the past five years it has become recognized by all dermatologists that the majority of all cases of vesicular eruption occurring upon the hands and feet are due to infection with ring-worm. In practically all of these cases either cracking or peeling can be found between the toes. The organism usually invades the adjacent portion of the soles and can be found deep in the heavy skin.

Treatment.—The best treatment is a strong salicylic acid ointment, from 1 to 2 drams to the ounce, the object being to peel thoroughly all of the affected skin. It should be kept up for at least six weeks. The stockings should be soaked over night in a weak solution of lysol and then washed in the ordinary way. Inasmuch as the disease usually comes from infected bath mats or towels, or from runways around public bathing pools or baths, canvas sneakers should be worn in bathing establishments both to prevent the infection and to keep infected persons from transmitting it.

Tinea Versicolor.—Tinea versicolor, or chromophytosis, is an infectious disease caused by a variety of ring-worm organisms and characterized by yellowish brown patches. It is usually a disease that is not common in the very cleanly. The disease is extremely superficial and is very mildly contagious. The most effective as well as the most pleasant form of treatment is to apply the following twice a day:

℞

Sodii hyposulphitis	℥ iii
Glycerini	℥ i
Alcoholis	℥ i
Aquae, q. s.	℥ vi

In exceptional cases one or two lesions may persist and here any of the ointments hitherto described for ring-worm may be used. Naturally it is better to employ medication after a bath with soap and water.

Verruca.—A wart is a small growth consisting of hypertrophied epi-

thelial and fibrous tissue, characterized by the presence of a circumscribed elevation and due to infection by a filterable virus whose exact nature is unknown.

There are many varieties of warts, but the following must be mentioned: the common wart, the digitate wart, the flat wart and the filiform wart. Common warts are most frequently met with upon the hands, but may also be encountered upon the face or other portions of the body. More rarely they are met with on the lips, or inside the mouth and nose. Upon the sole they form an excessively painful growth, inasmuch as the pressure of standing or walking forces them into the tissues. Digitate warts, with their long, fingerlike processes, are most common upon the scalp and are frequently spread by combing. Flat warts occur upon the hands, face and upper portion of the trunk of persons of any age. In the young they are the color of the normal skin, but in those past forty-five they are apt to show a considerable amount of pigment, especially when upon a covered surface. Filiform warts are most common upon the necks of women.

Treatment.—A common wart can be treated in many ways. The routine in many offices is X-ray. By means of this agent about 90 per cent of all common warts can be cured. The dosage should be heavy, about two full units being employed. The surrounding skin up to the edge of the wart should be thoroughly covered with lead rubber so that there is no risk of a burn. Fortunately plantar warts usually do very well under this treatment. If covered by a heavy mass of callus, the treatment should be a trifle longer. Where there are but few warts, the use of cocain and the actual cautery or of the high-frequency spark is usually very satisfactory. Excision is prone to be followed by recurrence. Very small warts, or warts upon the bearded area, are often best treated with the electric needle. Digitate warts upon the scalp can be curetted off, usually without an anesthetic, and the base touched with a stick of silver nitrate, not the ordinary lunar caustic. Filiform warts should be clipped and the base likewise cauterized. Flat warts are notoriously difficult to treat. These usually occur in large numbers and in the majority of instances will not readily yield to either the X-ray or radium. An exception to this rule is the large, soft, pigmented, flat wart of those past middle life. These lesions readily disappear by heavy radiation. At times the flat warts of the young will yield to the combination of protiodid of mercury, internally, ¼ grain three times a day, and to the external application of salicylic acid, either in alcohol or in ointment. Curiously enough this type of treatment seems to be much more effective when some of the warts are first removed by either the electric needle or the curet. Large numbers of warts upon any portion of the body offer a serious therapeutic problem. Occasionally a lotion consisting of 1 dram of salicylic acid to 3 ounces of alcohol, applied twice a day, will give a

brilliant result. In the majority of cases, however, each lesion should be dealt with individually.

DISEASES DUE TO ANIMAL PARASITES

Scabies.—Scabies, which is likewise known as the itch, Norwegian itch, Cuban itch, seven years' itch, French itch and army itch, is a contagious disease due to the Acarus scabiei, and characterized by papular and vesicular lesions over the abdomen, buttocks, internal surfaces of the thighs, anterior axillary folds, flexor surfaces of the arms, genitalia of men, and beneath the breasts of women. Under ordinary circumstances the lesions are also found between the fingers, to some extent on the hands and especially on the flexor surfaces of the wrists, particularly just beneath the thenar eminences. Hands which are much in water or much exposed to the cold are not involved. Persons who bathe frequently are not affected as seriously as those who bathe infrequently. The disease is very contagious and usually attacks most of the members of the household. It may be acquired from infected blankets. The lesions are in the horny layer of the skin.

Treatment.—The best drug is sulphur, although balsam of Peru is frequently employed. However, the latter drug is often irritating to both the skin and the kidneys and should not be used unless necessary. Despite some statements to the contrary, scabies can practically always be cured by sulphur treatment if the following precautions are used. The patient should first take a hot bath, using plenty of soap. Lather should be left on the body from three to five minutes and then washed off with hot water. As soon as dry, sulphur ointment should be rubbed in. This ointment should consist of 1 dram of precipitated sulphur to the ounce of vaselin, and should be absolutely smooth. Inasmuch as this form of treatment is irritating to almost every skin, particularly to that of women, it is essential that the ointment should be used for not more than three nights in succession, and that a rest period of from two to three days should intervene before a second course be given. Three courses are usually necessary in order to effect a permanent cure. The ointment can be used daily on the hands.

The bed linen should be boiled. The blankets can generally be disinfected in the following simple way: 2 drams of flowers of sulphur can be put over the upper sheet. The heat of the body will volatilize the sulphur to some slight extent and the blankets are thus disinfected. It is, of course, necessary to cure all members of a household, since one of them can easily respread the infection.

Pediculosis Capitis.—Head-lice are a common ailment in many homes. Children are only too prone to acquire this disease in school. If this

disease is once introduced into a home all members of the family are apt to be affected.

Treatment.—Many forms of treatment have been suggested. One of the best is to soak the hair with crude petroleum, wrap a towel soaked with it around the head and then bind a dry towel over this. The patient should be cautioned to keep away from the fire. This should be repeated for six nights. For the next week the hair should be washed daily with sodium bicarbonate or a weak solution of vinegar for the purpose of loosening the nits. It is frequently found that many of the ova have to be picked off by hand. Thorough soaking of the head in larkspur is also frequently effective. No matter what form of treatment is used, the hair should be carefully combed with a fine-tooth comb to remove dead parasites and nits.

Pediculosis Corporis.—Body-lice can cause intense suffering, as many of our ex-soldiers know from sad personal experience.

Treatment.—Many forms of treatment have been devised, but the following is probably the best: The clothes should be put into a steam sterilizer. The patient should have the axillary and pubic hair thoroughly shaved, and if there be much fine hair upon the body this should likewise be shaved. A weak sulphur ointment well rubbed into the skin for two or three days will complete the cure.

Pediculosis Pubis.—Pediculosis pubis, vulgarly known as "crabs," is an infection of the pubic region with the pediculosis pubis, and is usually acquired from an infected toilet.[2]

Treatment.—The best treatment is a thorough shaving of the hairs and the rubbing in of a sulphur ointment, or washing with a 1 to 500 solution of bichlorid of mercury. The classical blue ointment treatment may be dangerous inasmuch as it frequently causes a severe pustular folliculitis.

SKIN DISEASES DUE TO TOXEMIAS

There are many diseases due to either exogenous or endogenous toxins. Among the exogenous toxins the most common are various drugs; next probably rank poisonous foods, especially those to which the individual is sensitized; next serums and vaccines, and then the bacterial poisons; and lastly the inhalation of certain noxious gases. The endogenous toxins are naturally not so well understood. It seems certain, however, that the absorption of bacterial proteins from any area of focal infection may be responsible. The so-called auto-intoxication is apt to be a limbo into which the careless practitioner throws many unstudied cases. At the same time absorption from the colon probably can be responsible for some cutaneous troubles. It is barely possible that altered secretion from some

[2] The axillary region and even the eyelashes may be infected also.—Editor.

of the endocrine glands may be the cause of some toxemias. The possibility that an irritated autonomic nervous system is responsible for certain cases of toxemias, especially those associated with endocrine disturbances, is rapidly gaining ground. Toxins are excreted in several ways, through the kidneys, the digestive tract, the lungs and the skin. Hence it is not unusual to find that more than one of these paths is seriously involved.

Urticaria.—Urticaria, or hives, is an inflammatory affection of the skin due to the action of various toxins upon the blood-vessel walls, and characterized by formation of wheals of varying sizes. The disease may be either acute, subacute, or chronic; it may last for two days, or it may persist continuously for ten years. While it is most common upon the skin, the mucous surfaces may be affected. Giant urticaria is simply a large, circumscribed wheal. The association of hives and bronchial asthma is well known, but it should also be remembered that abdominal colic and arthritic pains are not infrequent (see article on the Visceral Manifestations of the Erythema Group of Skin Diseases, Volume IV, Chapter V, page 43.

In order to treat urticaria satisfactorily it is necessary to recognize the cause. The following scheme shows briefly some generally recognized etiological factors:

Foods.—Almost any food may cause urticaria in susceptible individuals.

Drugs.—Many drugs will cause hives; among the most common are quinin, acetylsalicylic acid, phenolphthalein and the various coal-tar products.

Horse Serum and Antitoxins.—These will cause trouble in a high percentage of patients to whom they are administered.

Bacterial Toxins.—Bacterial toxins, derived from either a focal or generalized infection, are rather infrequent causes. It is not generally recognized that syphilis causes some cases of chronic urticaria.

Animal Parasites.—Intestinal parasites, hydatid cyst, or scabies are frequently complicated by hives.

Intestinal Absorption.—Persons suffering from chronic constipation may have an absorption from the colon that is responsible.

Vagotony.—Certain cases of urticaria are associated with asthma, pylorospasm, colonic spasm, trophic rhinitis and other symptoms of a vagus disturbance. These are due to emotional irritation, anaphylaxis, or nervous reflexes from eye strain, adherent prepuce, etc.

Endocrine Disturbances.—It is possible that disturbances of the endocrine system may cause urticaria; certain of these are probably associated with the last-mentioned group.

Treatment.—The treatment of urticaria depends much upon the type and the cause. In the ordinary acute cases a purge should be given at

once, plenty of water should be taken and a limited amount eaten of *cooked* food only. The patient should not indulge in much exercise and should be kept cool. Externally a solution consisting of 1 grain of bichlorid of mercury and 20 grams of menthol to 6 ounces of alcohol will usually allay the itching. If this proves ineffective, substitution of 15 drops of carbolic for the bichlorid will usually suffice. The only object of the bichlorid is to fulfill the requirements of the prohibition act.

The subacute cases are treated in much the same way, but high colon irrigations given daily usually seem to work very much better than laxatives by mouth. It is important that the irrigations be given by one who knows precisely what he or she is doing; they should not be left to the patient.

The chronic cases are difficult to handle. In severe cases it is practically impossible to try any of the various food tests, and not infrequently we are forced to the clinical experiment of omitting certain articles from the diet of the patient. One fairly satisfactory scheme is to put the patient upon an exclusively milk diet for from five days to a week. If the urticaria becomes better, it is probable that the diet is the cause and a further search can be instituted. Exceptionally the removal of a focus of infection, such as a tooth, tonsil or appendix, will result in a brilliant cure, but this is rare. In some instances the treatment of syphilis will result in a cure of a chronic urticaria. Where a patient gives a history of chronic constipation, it is probably worth while to start treatment with high colon irrigations. In the vagotonic cases the causes of emotional irritation must always be searched for. The use of atropin is sometimes specific in these cases. Not infrequently it is impossible to determine the exact cause of urticaria and in such cases a long list of drugs have been recommended empirically. Some of the most generally recognized are hexamethylenamin, calcium lactate and dried adrenal substance. Externally the lotions mentioned under acute urticaria, or an ointment consisting of carbolic acid, menthol, zinc oxid and cold cream, prove grateful.

ECZEMA

Definition.—Eczema is an inflammatory affection of the skin, either acute, subacute or chronic in character, caused by diverse factors, either internal or external in origin, and characterized by inflammatory processes of various grades of severity. Eczema is now in much the same position that rheumatism was a decade or two ago and it is probable that within a brief span of time the word eczema will disappear from medical nomenclature. Already certain diseases have been definitely subtracted from the great eczema group. They are seborrheic dermatitis, dermatitis venenata, infectious eczematoid dermatitis, chronic impetigo, ring-worm of

the feet and hands, and neurodermatitis. The following table will show the most common causes of eczema:

A. External causes
   1. Irritation
      a. Clothes, chiefly fur and wool
      b. Soap and water
      c. Plants, chiefly primrose
      d. Occupations, due to various chemicals
      e. Cosmetics and hair tonics
      f. Weather
   2. Infection
      a. Bacteria
      b. Ring-worm

B. Local predisposing causes
   1. Xeroderma
   2. Disturbances of circulation, such as varicose veins
   3. Excessive sweating

C. Internal causes
   1. Disturbed vegetative nervous system
   2. Urticaria
   3. Malassimilation of food (infantile eczema)
   4. Possible anaphylaxis to foreign proteids, either food or bacterial

D. Combined causes
   1. Usually a combination of an internal cause plus an external irritant

Treatment.—Any physician who makes a diagnosis of eczema and makes no search for the cause is not a good therapeutist, for it is only by removing the causal factors that a recurrence can be prevented.

Naturally the lesions found in eczema vary greatly; they may be erythematous, papular, vesicular, pustular, squamous, verrucose, weeping, and of an intense red color that goes under the name of rubrum. Naturally both the general and local treatment of eczema vary. An eczema due to sensitization from eggs can hardly be treated in the same way that an eczema due to hair tonic would demand. Nor can a weeping eczema be treated like a thickened patch of squamous eczema. The first essential is to relieve the irritation in practically any type of this disease. The X-ray in one-quarter skin unit doses, weekly, gives the best and quickest therapeutic results. In addition to the X-ray a soothing lotion such as a calamine lotion or calamine liniment should be employed in practically all acute cases. In the chronic cases a very little of a stimulating ointment may be used daily. Salicylic acid in the strength

of 15 grains to the ounce may be safely used in conjunction with the X-ray. If the X-ray is not used the treatment is similar, except that a much stronger ointment should be employed in chronic cases.

Irritation should be scrupulously avoided. Except in the very thickened squamous types, soap should never be employed. Very acute lesions should be cleansed with normal saline, olive oil, top milk or cold cream. Wool should never touch the affected parts. All sources of chemical irritation should be avoided. The skin should be protected against either marked heat or cold.

Eczema due to external irritation is sometimes rather difficult to handle. Women often have to do much of their own housework, and soap and water, especially strong washing soap, will raise havoc with their hands. In such cases a mop should be used as much as possible. Rubber gloves are of no value unless changed at least every ten minutes and kept thoroughly dry. In cases of chronic irritation upon the body the Unna's glycerin gelatin paste will often work very well.

Eczema grafted upon an abnormally dry skin is always difficult to handle. In such a case a superfatted soap should be used for cleansing purposes. Some bland ointment, such as cold cream or even cocoa butter, should be rubbed into the skin immediately after a bath or else applied in an extremely warm room. Oil rubs by a competent masseur are also excellent as a prophylactic. Once an eczema has become established it should be treated with some preparation which is not too drying such as calamine liniment or Lassar's paste.

Eczema due to varicose veins is difficult to handle and is prone to end in ulceration. Naturally the best treatment is an operation for the varicosities. The medical treatment consists in keeping the feet elevated as much as possible and in the use of a soothing, protecting covering. Especially to be recommended are calamine liniment, Lassar's paste and Unna's zinc oxid gelatin paste. The X-ray will often relieve the itching to a great extent.

Neurodermatitis is a clinical entity that can be readily distinguished from ordinary eczema by its distribution, for it occurs chiefly in the flexor surfaces of the elbows and knees and around the neck. Not exceptionally it may be found in the axillæ, groins or nucha, and still more rarely on other portions of the body. Almost invariably other signs of vagotony may be recognized. It is extremely prone to recur. In the treatment of this distressing condition any factor that upsets the emotions should be removed. Focal infection or any abnormality that might set up a reflex nervous irritation should be eliminated and the food should be carefully studied. The X-ray is the one external therapeutic agent that seems to affect the lesions satisfactorily.

Infantile eczema is still a source of much dispute. Some authors claim that it is due to a hypersusceptibility to some common foreign pro-

tein taken with the food; in the case of nursing children the mothers may eat some substance to which the child is hypersensitive. Other authors claim that there is a failure upon the part of the child to assimilate properly some of the fats or carbohydrates. In the light of the best information it would seem wise to try the cutaneous food test on eczematous infants, and to eliminate from the diet any substance to which the child reacts. It is frequently comparatively easy to clear up the skin of an affected child if one reduces the fat or carbohydrate intake to a point where the child no longer gains weight, but good judgment should certainly indicate that a gain in weight is much more essential than the removal of a few blotches. Locally the treatment is much the same as that for any other eczema. Many dermatologists, however, claim that an ointment consisting of 1 dram of crude coal-tar to an ounce of Lassar paste will often work wonders. The ointment should be applied thickly and allowed to remain for twenty-four hours, a bandage being necessary to keep it in place. It is then carefully removed, usually with oil, and redressed. An ointment which the author has found especially useful is one consisting of 12 grains of yellow oxid of mercury to an ounce of white vaselin.

Eczema of the eyelids is frequently due to watering eyes and demands a visit to an oculist. A concentrated solution of boracic acid often combined with the daily use of an ointment consisting of 5 grains of yellow oxid of mercury to the ounce of white vaselin is useful. In exceptional instances weekly doses of one-eighth unit of the X-ray may prove of marked benefit.

Eczema around the mouth, eczema orbiculare, is frequently due to moistening the lips with the tongue, or at times to an irritating tooth paste. Naturally the licking habit must be discouraged, and at times an ointment containing quinin or aloes will have the desired effect. Treatment is along the lines already indicated.

Eczema of the upper lip is frequently due to a discharge from the nostrils. When this is corrected the lip usually heals.

Eczema of the nails is not uncommon. It must be distinguished from psoriasis and the more common ring-worm. If the disease is not ringworm the X-ray will usually be of benefit.

Anal eczema may be due to intestinal parasites, fissures, hemorrhoids or other local conditions. At times it is probably due to a local streptococcus infection. One of the most useful medicants consists of salicylic acid, 20 grains; glycerin, 10 minims, and equal parts of alcohol and water to make 3 ounces. This should be applied twice daily. Quarter unit doses of X-ray given at weekly intervals may also prove useful.

SKIN DISEASES OF UNKNOWN ETIOLOGY

Psoriasis.—Psoriasis is a chronic inflammatory disease characterized by various sized papules, covered with white scales, and of unknown etiology, despite many elaborate investigations. Pathologically, the disease is extremely superficial. There is some dilatation of superficial vessels in the corium, but deeper than this no changes can be demonstrated. It is usually possible to free the patient temporarily from most of the lesions, but the disease almost invariably recurs, sometimes within a week or two and sometimes not for years. The general hygiene of the patient should always be looked after, for it is well known that the eruption is worse when the vitality is low. Freedom from mental strain or physical overwork will frequently prove of benefit. As a matter of fact, almost anything that "shakes up" the patient will do one of two things, either make the disease worse or better.

Treatment.—Under ordinary circumstances a mild case of psoriasis may be treated as follows: As much exposure as possible should be given to the direct rays of the sun; sunlight filtered through window glass is not effective. Lesions upon the body are usually best treated with chrysarobin. The cleanest way to use this drug is to have a saturated solution of it in chloroform, to paint this on the lesions and then to cover with flexible collodion. The most efficient method is to use an ointment in the strength of 30 grains to the ounce; this should be thoroughly rubbed in once a day. There are two objections to chrysarobin: (1) it is irritating to the skin and must soon be discontinued; (2) it is extremely dirty and will permanently soil linen. Chrysarobin should never be used near the eyes and usually not upon the scalp. For these locations an ointment consisting of from 1 to 2 drams of ammoniated mercury to the ounce is safer and usually as effective.

In the cases which have thickened patches of long standing, it is customary to first try a strong chrysarobin ointment thoroughly rubbed in. If this prove ineffective it is not worth while to try any other salve. The X-ray administered in quarter unit doses at weekly intervals is often of the greatest service in dealing with these lesions. As time goes on, however, it will occasionally lose its charm. Ultraviolet light is a complete failure in this type of psoriasis; in fact its only use in combating this disease appears to be in lesions located upon the scalp.

Either acute, rapidly spreading cases or long-standing cases with some excessively stubborn patches usually demand special treatment. Internally much has been tried. Many men feel that a diet low in protein is a benefit, but the author has seen half a dozen cases which had been upon a rice diet for a considerable space of time without the slightest benefit

having resulted. It is extremely doubtful if diet will markedly affect psoriasis.

Arsenic has been much used but is usually of little avail. Vaccines of various kinds have been much tried, but are likewise useless. Autoserum therapy, described in the first section of this chapter, will sometimes prove very useful. It is believed to be more effective when followed by the use of a weak chrysarobin ointment, say 15 grains to the ounce. Autoserum therapy should be used on the average of three times at intervals of from three to five days. Colonic irrigation is occasionally a benefit. The intravenous use of a bacterial protein as represented by the ordinary colon or typhoid bacteria used in sufficient quantity to produce a protein shock will sometimes exert a most marked influence. The initial dose should not be higher than 50,000,000.

Another treatment that is being used in certain cases is X-ray therapy over the thymus gland. Care should be taken that a stimulating and not a destructive dose is applied. The recommended technic is as follows: focal skin distance, 9 inches; milliamperage, 4; spark gap, 8 inches; time, 2 minutes; filter, 2 millimeters of aluminum. This should not be repeated oftener than once in ten or twelve weeks. The effect from it may not become manifest for from three to six weeks.

Taken all in all, there is no royal road toward cure in this disease. The number of remedies which are recommended is sufficient proof of this fact. It is often necessary to resort to a variety of methods before any benefit is found, and it is questionable whether the patients who have psoriasis only upon covered areas should receive much treatment. Certainly long-continued X-ray should never be administered.

Herpes Simplex.—Herpes simplex is an acute inflammatory disease, characterized by groups of vesicles upon inflamed bases, and possibly due to irritation of a nerve. The lesions may occur upon the skin, where they are spoken of as herpes, or "fever blisters"; upon the lips, where they are usually known by the latter name; upon any portion of the buccal mucosa, where they are designated as "canker sores"; and upon the genitalia, where they are known as "herpes progenitalis." Apparently some of the cases are due to gastric disturbances, some to eating of food against which the individual is sensitized, some to too much exposure to the elements, or at times to a filtrable virus.

Treatment.—Inasmuch as the exact cause is unknown, no method of prevention can be advocated. The lesions run a self-limited course, and treatment has but little effect. Some authors believe that an early lesion can be aborted if spirits of camphor be applied in the earliest stages. Some years ago the author saw an epidemic of fifty cases following upon the eating of canned crab meat. These cases were divided into three groups: one-third of them were treated with astringent lotions; one-third with various ointments; and one-third were left untreated. All recovered

within twenty-four hours of each other. However, calamine lotion or liniment will frequently allay any itching or burning. Sores within the mouth seem to heal more rapidly if touched with a stick of silver nitrate.

Pruritus.—Pruritus is an itching disease of the skin without any anatomical explanation. There are many causes and the following must be mentioned: jaundice; the use of certain drugs, especially opium and its derivatives; an abnormally dry condition of the skin; various types of digestive disturbances; irritation from woolen clothes, or from soap; possibly a skin habit secondary to some itching dermatoses; a neurosis, either due to a feeling of self-reproach or to some complex, usually sexual in origin.

A localized pruritus around the anus and genitalia occurs in both men and women. A close examination will frequently reveal that certain of these cases are due to either an infection with ring-worm or streptococcus; that others are due to an irritation arising from the lower portion of the digestive tract; pin-worms, fissures, or hemorrhoids may be responsible. Glycosuria must always be excluded. It seems certain that in the vast majority of cases the disease is a sexual neurosis, and that some simple psychanalysis will usually reveal the underlying cause.

Treatment.—This necessarily depends upon the etiology of the condition. Every patient necessarily demands a careful physical, and frequently a mental, examination. Where the cause cannot be definitely ascertained treatment must be largely along the line of physical and mental hygiene. Tea, coffee and alcohol should be practically prohibited. Exceptionally, results may be obtained from large doses of hexamethylenamin or from the tincture of cannabis indica, which should be given in from 10 to 30 minim doses, three times a day. Other sedatives may occasionally be used with success. General galvanization may aid. Externally the whole gamut of antipruritic drugs is usually employed with varying degrees of success. The ultraviolet lamp will occasionally prove a benefit.

In the local varieties it is likewise essential to rule out any organic disease of the neighborhood. The same preparations may be tried as for the generalized pruritus, but tar may likewise be used and is sometimes very valuable. In the severe cases small doses of the X-ray, repeated from time to time, may control the symptoms, but it must always be remembered that many such fractional treatments may favor the development of a radiodermatitis. The sensory nerves supplying the part are sometimes cut, and this usually gives relief, although recurrence may take place at a later date. Murray claims that a streptococcus infection is responsible for most of the cases of pruritus ani, and that he has obtained excellent results from the use of a streptococcus bacterin. In view of the rather intractable nature of the trouble this treatment should be given a further trial. In some cases alcohol injection has been tried into the

deep tissues and nerves that supply the itching part, but it should always be remembered that this may be followed by abscess formation.

BENIGN NEW GROWTHS

Senile Keratosis.—A senile keratosis is a thickening of the horny layer and rete developing upon a flat pigmented patch so common in those past middle age. Exposure to the sun's rays, strong alkali solutions or anything that tends to dry or age favors the development of this lesion. It is especially common in individuals who have sandy hair and freckles. The condition is unquestionably a localized old age of the skin. Clinically the first abnormality noted is an oval yellowish patch; this gradually becomes a trifle darker and a thin scale develops. Eventually the color becomes almost black and the scale becomes thicker. A considerable percentage of these lesions will become malignant unless removed. It is excellent life insurance to destroy the trouble before malignancy develops. Pathologically, the lesion is superficial, although there is a marked cellular proliferation in the upper portion of the corium.

The early lesions cannot be removed by the frequent application of a bland ointment as many authorities state. The author considers that the best treatment is X-ray. A two-unit dose, possibly repeated in four weeks, almost invariably cures the lesion promptly and without any disfigurement. He has seen many cases which have been well for ten years.

Radium in a double erythema dose will unquestionably accomplish the same results. Theoretically the use of radium might seem objectionable inasmuch as so many of these lesions are due to light; but practically this is not true. Small lesions can be excised or curetted off and the base touched with an actual cautery. Fulguration under a local anesthetic will also be successful. However, the X-ray will produce less temporary discomfort and a greater certainty of cure than any other method.

Pigmented Nevus.—This lesion is also known as a pigmented mole, a mole or birthmark. It is a congenital overgrowth of nevoid cells whose origin is still uncertain. These cells are situated in the upper portion of the corium, but there are almost invariably some strands at a slight distance from the main body. Clinically, there are a number of different types; the common, pigmented moles, sometimes without hairs and sometimes containing stiff hairs; the yellowish nevi of varying sizes, sometimes so large as to cover half of the bodily surface; and the blue nevi.

Treatment.—With the exception of the nevi containing much hair, there is some risk of a very malignant type of melanoma (melanotic sarcoma or melanotic carcinoma) developing as a result of irritation. It is generally conceded that any pigmented growth which is acquired, or which shows signs of growth, or which is subject to irritation, should be

removed as a prophylactic measure. The treatment of a malignant mole is practically hopeless even if the lesion is treated at a very early stage.

The very large growths should not be touched; the growths not more than one-half inch in diameter can be removed by the knife, by the electric needle, by the cautery, by fulguration, or possibly by carbon dioxide snow. No matter what method is used, it is imperative that all of the nevoid cells be destroyed. To leave any cells behind is directly to invite serious trouble. Radiation is not successful unless used to the point of a second-degree burn, and a burn with the actual cautery is infinitely superior to an X-ray burn. One of the difficult problems is to decide just how a growth varying from one-half to one and one-half inches in diameter is to be treated. As most all of these lesions contain a considerable amount of hair, they are not especially apt to become malignant. The X-ray may be used in a two-unit dose to remove most of the hirsuties; then a rest of three months given to make sure that the hair will not return. Carbon dioxide snow applied for one minute and fifteen seconds with deep pressure over a small portion of the mole at a time will usually result in causing a considerable diminution in pigment and will leave very little scarring. In treating such lesions, it is always advisable to use several layers of adhesive to protect the normal skin up to the edge of the lesion. The whole surface of a large nevus should never be covered at once, as the resulting scar might cause a considerable amount of contracture. There is no reason why the actual cautery cannot be substituted for the carbon dioxide snow, using a local anesthetic and destroying but a limited amount at each application. Small moles containing much hair can be treated in two ways. Much the best way is to needle out each hair individually; this will usually destroy the mole. The second way is by irradiation, but it will usually take about three times the normal epilating dose to accomplish permanent results. Blue nevi are usually rather small, but are said to become malignant rather readily. They are best destroyed by the cautery or fulguration.

Vascular Nevus.—A vascular nevus is a congenital new growth and hypertrophy of the blood-vessels of the skin. The only exception to the rule that these growths are congenital is in the case of telangiectasias, the majority of which are acquired. Several groups must be recognized: (1) the small telangiectatic spots; (2) the flat nevi; (3) the tumors containing spongy tissue that resemble erectile tissue and that protrude considerably above the level of the skin, and (4) the racemose aneurysms or blood-vessel lakes. Pathologically all of these lesions consist of dilated blood-vessels which have almost normal walls.

Treatment.—The small spider nevi, that is, growths with one brilliant red central spot only a millimeter or two in diameter and small vessels branching out from this, are best treated by introducing the point of an electric needle and running from 1 to 3 ma. of current in for one-

half to two minutes. Such lesions can also be successfully treated by touching the central spot with the electrode of a high-frequency machine. Single small vessels, such as occur upon the face or neck as the result of exposure or of rosacea, can be cured by introducing an electric needle into the lumen, just as in the case of a spider nevus. Where there are numbers of telangiectasias a variety of methods are applicable. The best method is probably the ultraviolet lamp. A compression quartz lens should be used, firm pressure employed and the treatment should last for from five to twenty-five minutes. This method of treatment will often yield brilliant results in X-ray and radium telangiectasias. Carbon dioxide snow can be used with firm pressure for from twenty-five to fifty seconds, but a certain amount of scarring always results. Multiple scarification using a small double-pointed knife and making the little incisions as near right angles to the course of the vessels as is possible will also frequently yield good results. This method has been much utilized in rosacea.

The flat nevi are frequently difficult to treat. The ultraviolet lamp is unquestionably the best method of treatment that we have at our disposal. It produces no scar, but its results are somewhat uncertain. Very dark lesions can usually be made much lighter, but there is generally a point beyond which any beneficial change ceases to go. Treatment with a lamp must necessarily be with a compression lens, and an exposure of from ten to thirty minutes. Radium has been much advocated, but it can act only by producing scar tissue and a radium scar can hardly be considered preferable to a flat nevus. The actual cautery or fulguration will invariably cause a considerable amount of scarring.

The elevated tumors can usually be better treated by radium than by any other method. There is still some discussion as to whether the beta or gamma rays should be utilized. MacKee recommends from 1/10 to ¼ mm. of aluminum or an equivalent filtration, and an exposure that will do no more than cause a slight erythema as the ideal method. Such doses should be administered once every three to four weeks. Simpson advocates the use of 1/10 mm. of lead and the avoidance of any reaction if possible. Many of the small lesions can also be successfully removed by the use of carbon dioxide snow. Firm pressure for one minute and fifteen seconds is necessary, and usually from one to three applications are needed. The interval between treatments should be from two to three weeks. The resulting scar is usually soft, white and pliable. The actual cautery can also be utilized, but the scar is usually rather more noticeable.

The large, red blood lakes are frequently very difficult to handle. It is difficult to treat them surgically because hemorrhage will frequently obliterate all landmarks, and it is necessary to tie up every entering vessel. Carbon dioxide snow can often be used advantageously in lesions which are not more than one-half inch in diameter. It works by producing an obliterating endarteritis and not by actual destruction of the lesion. Deep

pressure should be made from two to three minutes and treatments should be from three to five weeks apart. Radium will also act well upon some of these lesions. Gamma radiation should be employed and it is necessary to produce a slight reaction upon the skin. Cross-fire method of attack should always be utilized in order to spare the skin.

Keloid.—A keloid is a fibrous new growth that is to all intents simply a markedly hypertrophic scar. It invariably results from some slight or severe injury to the corium. Pathologically the change is entirely in the corium and consists of a marked increase in the number of bundles of white fibrous tissue.

A keloid should never be treated surgically. After excision recurrence is practically certain, both along the line of incision and in the needle holes. Even if no sutures are put in the wound and the edges are held together by adhesive plaster, recurrence is sure to follow. The use of the cautery or of fulguration gives even worse results, the keloid being larger. Caustics or irritants have precisely the same effects. The results obtained from irradiation are most gratifying. In every case that is well treated, the keloid can be made to disappear. In the case of large growths a considerable amount of filtration should be employed, and the dose should be just sufficient to cause a slight erythema. It is not infrequent to find that shrinkage will continue for three or four months after a treatment. The author is inclined to feel that the following technic is the best: For small growths not over ¼ inch in depth use 1 mm. of aluminum, and just sufficient radiation to give a slight erythema. Repeat this in from three to four weeks, then allow the patient to wait from two to three months. If any sign of the keloid still remains, give two more similar treatments. In the case of large keloids use from 2 to 4 mm. of aluminum and treat in the same way. Pedunculated keloids should be excised and radiation should be begun at once upon the scar. In many instances some telangiectasia will follow the treatment of keloids with either X-ray or radium, but this can be satisfactorily removed by means of the ultraviolet lamp.

MALIGNANT NEOPLASMS

The problem of cutaneous cancer is a serious one, for nearly 2 per cent of all patients who consult a dermatologist do so because of cancer, thus proving how frequent the condition is. If these growths are not recognized and treated at an early date the ultimate outlook is very serious. There are three types of skin cancer: the basal-celled cancer; the prickle or squamous-celled cancer; and the malignant mole, or melanotic sarcoma or carcinoma.

Cancers.—*Basal-celled cancers* usually arise from senile keratoses or from subepidermal nodules, and practically never from normal skin. The growths are most common upon the face, especially around the nose or eyelids, and are rare upon the limbs or body. *Squamous-celled cancer* many arise from senile keratoses, especially those of the lips and hands; arsenical keratoses; cutaneous horns; scars from burns or wounds that have healed by granulation, and especially from leukoplakia. Squamous-celled cancer is very frequent on the tongue and lips, but is also relatively common upon the extremities and trunk. In contradistinction to the basal-celled cancer the lesions grow rather rapidly and usually metastasize into the neighboring lymph-nodes. *Malignant moles* spring from the ordinary type of raised or flat pigmented, non-hairy moles, or from various types of soft nevi. Naturally, all types of cancer are much more apt to develop in abnormalities which are subject to chronic irritation.

Treatment.—The prophylaxis of cutaneous cancer is not a difficult one. It simply demands that every abnormality of the skin should be watched. If any abnormality is subject to irritation it should be immediately and thoroughly removed. This is simply an excellent form of life insurance.

In treating a basal-celled cancer it is essential to remove every cell. Various men have various forms of treatment which they advocate: some believe in the knife, some in the actual cautery, others in the curet and caustic, and still others in either the X-ray, radium or electrocoagulation; a few believe in caustic paste. The knife has the advantage of leaving a wound that heals speedily and leaves but a small scar, and of furnishing tissue that can readily be examined histologically. Surgery has the disadvantage that many persons seriously object to operation, that operation in certain localities may yield a bad cosmetic result, and that hence there is a temptation not to be sufficiently thorough. The actual cautery is invaluable where a comparatively narrow margin must be given the growth. The resulting scar is usually not nearly so severe as one might expect. One favorite method of treating superficial cancer is to curet thoroughly the entire lesion under an anesthetic, then to swab the whole area with acid nitrate of mercury, and to almost immediately add a considerable quantity of sodium bicarbonate. This will form a protective crust over the wound.

The X-ray has been extensively used in the treatment of skin cancer and in the hands of competent operators has given excellent results. For small, superficial lesions an unfiltered ray should be employed and the dose should be at least two to two and one-half skin units. Treatments are given at intervals of from three to five weeks. Ordinarily from three to four treatments are necessary. The author feels that it is always wise to give one treatment after all signs of the disease have disappeared. In the case of extensive lesions, or lesions where there is a considerable amount

of induration, filtration must necessarily be employed. From 1 to 3 mm. of aluminum is all that is necessary. In very deep lesions it is probably of some advantage to increase the focal skin distance, using twelve inches instead of eight or nine. This is believed to give a more uniform distribution of the rays, and a greater dose beneath the skin. The dose should be sufficient to cause a mild, first-degree erythema, and treatment should be repeated in from three to five weeks. Radium will accomplish nothing that the X-ray will not, although it is more convenient to use in certain areas. In the treatment of skin cancer, needles are preferable to plaques, and sufficient dosage should be employed to produce a marked first-degree dermatitis. At the present time we have no final statistics as to the results obtained from radium therapy in cutaneous cancer.

A new method which is coming into some vogue is desiccation, or electrocoagulation. This method is simply the application of a long spark derived from a powerful high-frequency outfit. For small lesions a local anesthetic will suffice, but at times a general anesthetic must be employed. The tip of the electrode should be held close to the diseased tissue, or even buried in it. This method is claimed to generate heat from the tissues themselves and to give a wider area of tissue destruction than does the cautery. The scars are stated to be comparatively slight. Unfortunately none of the advocates of this method have as yet published their final statistics in a convincing form.

Caustic pastes are used by few dermatologists, but by most cancer quacks. Zinc chlorid may be used in the form of Bougard's paste:

℞

Farinae	ʒ ss
Pulv. amyli	ʒ ss
Acidi arseniosi	gr. iv
Hydrargyri sulphatis rubrae	gr. xx
Ammoniae chloratis	gr. xx
Hydrargyri chloridi corrosivi	gr. ii
Zinci chloridi	ʒ iv
Aquae	℥ i

This paste is spread on gauze and applied over the area to be destroyed. The plaster should remain in position from twenty-four to forty-eight hours, and a fresh application may have to be made once or twice. The separation of the slough requires from ten to twenty days. Arsenic pastes are still more popular, being used in the form of Marsden's paste:

℞

Acidi arseniosi	ʒ ii
Mucilaginis acaciae	ʒ i

This paste is applied just as is the last, but twelve hours' exposure is usually sufficient. It should never be employed over large areas because of the danger of absorption. Cancer pastes usually cause intense suffering while being applied and it would seem much kinder to employ the cautery or an anesthetic.

In summing up the results obtained by treatment it may be said that surgery and the X-ray will yield the same percentage of cures—about 95 per cent in selected cases, and 87 per cent in unselected cases.

If prickle-celled cancers are seen before they are two months old it is highly probable that local removal will suffice; however, a patient's word should never be taken upon this point no matter how honest or intelligent he may be. If the growth be more than two months old, or if it is growing rapidly, in the vast majority of instances the neighboring lymph-nodes should be removed by a block operation. X-ray or radium will not destroy all cases of squamous-celled cancer despite statements to the contrary. The author has seen a growth of less than a month's duration, and not more than one-quarter of an inch in diameter, absolutely resist a second degree radiodermatitis. At the same time in certain instances the X-ray will yield brilliant results. In the author's hands about 25 per cent of unselected cases have been permanently cured. As a general proposition, however, the disease is essentially a surgical one.

The treatment of a malignant mole is essentially prophylactic. As already pointed out, every pigmented mole that is subject to irritation and every acquired mole should be completely removed. Once malignancy has been established, operation is useless in the case in which there is widespread dissemination through the blood-vessels. However, it should be remembered that there are cases in which metastases takes place through the lymphatics alone. In such cases complete local operation, combined with block dissection of the lymphatic, will cure an occasional patient.

DISEASES OF THE HAIR

Alopecia.—Alopecia is an abnormal loss of hair, due to either local or general disorders, which usually affects the scalp but may involve any portion of the body. It is an extremely common affection inasmuch as it occurs in almost any systemic disturbance and also in most of the seborrheic disturbances. The following classification will give some idea as to the various causes:

A. Congenital alopecia
B. Senile alopecia
C. Premature alopecia
   1. Idiopathic, due to hereditary predisposition

2. Symptomatic
   a. Local diseases
      Seborrheas
      Pyogenic infections
      Psoriasis
      Lupus erythematosus
      Syphilis
      Ring-worm
   b. General diseases
      Any acute fevers
      Pregnancy
      Syphilis
      Leprosy
      Neurasthenia
      Chronic intoxications
      Any wasting disease
      Anemia

The loss of hair is due to either the loss of follicles, to a disturbance of nutrition, or to a circulating toxin.

Treatment.—In all instances it is important to ascertain whether the loss of hair is due to a general or local cause. A scalp should never be examined immediately after washing, as it is practically impossible to determine whether the hair is dry or oily or what degree of seborrhea is present. Naturally it is important to correct any disease of the scalp or any disturbance in general health. An excessive amount of sunlight is often bad for blond hair. The scalp should be well ventilated both by day and night. This means that a light hat should be worn and a firm pillow should be used. The hair should never be allowed to become dry and lusterless as this type of hair always falls fast.

The scalp should be stimulated. This may be done by massage twice a day. In massaging the scalp it is particularly important to manipulate the areas in front and behind the ears, as much of the blood supply enters in that locality. Three fingers should be firmly fixed upon the scalp and the scalp rubbed vigorously over the underlying bone until a brisk tingle is felt. Naturally this should be done by the affected individual himself. Electrical contraptions for massage are in no wise superior to this simple method. One of the best stimulating tonics consists of:

℞

Hydrargyri chloridi mite	gr. i
Acidi salicylici	ʒ i
Glycerini	♏ xv
Alcoholis	℥ vi

Pilocarpin is much recommended by certain authorities and, if desired, 15 grains can be added to the above prescription. The author can see no advantage in its use. Cantharides and resorcin are also much used in tonics. However, it should be remembered that resorcin can stain either white or blond hair to a disagreeable greenish hue.

Where the hair is dry it should be oiled at such intervals as to prevent dryness. Any good vegetable oil may be used. Olive oil and white petroleum oil are two favorites. In the case of women an oil-dampened cloth (not oil-soaked) should be rubbed down to the ends of the hair.

The ultraviolet ray will frequently stop hair from falling when there is no ascertained cause. Naturally it is also useful where seborrhea is a factor in the alopecia. For the first six weeks treatment should be given every seven days. The scalp should be exposed from the back, the sides, and the top, and the time should be long enough to cause slight redness and desquamation. The average exposure for each area is about ten minutes, with the lamp about four inches distant. The glabrous skin should be covered with a towel or adhesive. After the first six treatments, the interval may be increased to two or even three weeks. Treatment should be kept up for about six months.

After an acute fever it is not necessary to cut the hair or shave the head. At times it is convenient to bob the hair, as hairdressing is made easier. Persons who have lost hair as the result of an acute infectious disease should be reassured that the hair is practically certain to return.

Alopecia Areata.—Alopecia areata is a disease of unknown etiology, characterized by the falling of hair in circumscribed patches. While the disease is not an uncommon one, its cause is totally unknown, and hence the treatment is purely empirical.

Treatment.—Good food, plenty of sleep, exercise in the open air, in fact proper hygiene in general should be rigidly enforced. The local treatment consists in the application to and just beyond the borders of the patch of some stimulating antiseptic preparation. It is always well to try different remedies on different patches and then note the results. In the author's experience the best preparations have been: painting the involved area with pure carbolic acid and swabbing off with alcohol as soon as whiteness develops; anointing the areas with ½ dram of pyrogallic acid to 1 ounce of vaselin; painting upon the patch a saturated solution of chrysarobin in chloroform, and covering this with a layer of flexible collodion; painting upon the bald spot a solution composed of 1 dram of salicylic acid dissolved in an ounce of flexible collodion; using a solution composed of 1 dram of the oil of tar dissolved in an ounce of flexible collodion.

The ultraviolet lamp is advocated by many men.

There are dozens of other remedies advocated; their number shows that no one is always effective.

Hypertrichosis.—Superfluous hair is a growth which is abnormal in amount or which occurs in places where only the lanugo should be found. Any hair upon the face of a young woman is abnormal. There is no reason to believe that the use of grease can possibly cause the development of such hair. The etiology is unknown and the only satisfactory form of treatment is the removal of the hair.

Treatment.—There are three forms of treatment: (1) epilation or removal by various pastes, or by shaving; (2) Roentgen ray treatment; and (3) removal by means of the electric needle. Epilation is always followed by an increased stiffness of the hairs and should never be resorted to. The depilatory salves also make the condition worse in the long run, and it is more than doubtful if their use should ever be advised. A typical salve of this type is the following:

℞

Barii sulphureti	ʒ iss
Zinci oxidi	ʒ vi
Carmini	gr. i

This powder is mixed with enough water to make a paste and then applied to the part and washed off in three minutes. Another favorite formula is:

℞

Sodii sulphidi	ʒ ii
Cretae preparatae	ʒ vi

This is made into a thick paste with water, applied locally and allowed to remain for fifteen minutes. As soon as it causes a sensation of warmth it is washed off.

While it is well known that the X-ray will permanently destroy hair, still it is apt to leave a permanent disfigurement as the result of a burn, for the hair can rarely be made to fall permanently without at the same time producing a dermatitis. The best X-ray operators at the present time refuse to treat hypertrichosis.

The best way of removing superfluous hair is by means of the electric needle. The apparatus needed is one which will furnish a steady galvanic current. Either a silver chlorid electric battery or a galvanic wall piece may be utilized. A needle holder, a fine, pliable needle—some men advocate jeweler's broaches—and a sponge are necessary. As a general rule from 1 to 2 ma. of current are all that can be borne. The use of much current may result in permanent scarring. The needle must always be attached to the negative pole. To the positive pole is attached a cord that connects with a sponge which the patient holds in

the hand. The operation is simple after one has had some practice. The face should be thoroughly washed with alcohol so as to dehydrate the surface and prevent the destruction of the superficial cells. Then the follicle must be catheterized. One can usually tell by the "feel" if the needle has entered the follicle. The needle should enter to a depth of about an eighth of an inch, the depth varying according to the length of the follicle. After one or two hairs have been extracted the depth of the follicles can be accurately ascertained by inspecting the roots. To aid in determining the direction in which the hair enters the skin it is sometimes essential to make traction upon the hair and catheterize at this time. When once the needle is in position, the patient grasps the sponge so as to make the circuit complete. As much current should be used as the individual can comfortably stand. Minute air bubbles can usually be seen emerging from the mouth of the follicle, and later a wheal-like elevation forms. The needle should remain in position from thirty to sixty seconds. Then the sponge is released and the needle withdrawn. The hair should extract with the greatest ease; if it sticks it is a sign that the follicle has not been completely destroyed. An expert operator can usually destroy 80 per cent of the hairs at his first try, but a novice can rarely destroy more than 50 per cent. The destruction is permanent; if a weak current is used the little operation is painless, and no scarring remains if one is careful not to treat adjoining follicles upon the same day. In other words, in the hands of an expert operator the results are very satisfactory. However, two facts must always be borne in mind: (1) that where there are many long light hairs the stimulation from the electric current may cause them to become both darker and coarser; and (2) that as time progresses certain of the lanugo hairs will become dark and stiff, so that it is usually necessary to remove new hairs from time to time. Both of these facts should always be carefully explained to the patient so as to prevent disappointment.

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MINOR SURGICAL AILMENTS

CHAPTER XXX

NON-OPERATIVE TREATMENT OF BORDER-LINE SURGICAL CONDITIONS

WILLIAM CORE DUFFY

BURNS

Introduction.—The handling of severely burned cases is a task for a hospital staff with special nursing facilities and a surgeon of experience to supervise and better still to take an active part in the treatment. However, since the relatively minor burns greatly outnumber the ones of serious degree and in view of the fact that many physicians in industrial work and in small communities must handle even the graver cases, it seems wise to cover this subject here, particularly in its larger non-operative phases.

Burns are caused by dry or moist (steam) heat, acids, caustics, lethal gases (such as "mustard"), electricity, and friction (combined heat and trauma).

Classification and Pathology.—The most practical classification is that generally employed in America, namely: (1) *burns of the first degree,* which involve the epidermis only and are manifested as an erythema; (2) *burns of the second degree,* characterized by the formation of blisters owing to exudation of serum from the injured corium; burns of the second degree may not be obviously present in the first few hours but in the course of twenty-four hours blistering appears; (3) *burns of the third degree:* there is destruction of all the layers of the skin, which in such areas assumes a white appearance as if cooked. Those of the third degree also include instances in which there is more or less involvement of the tissues beneath the skin.

Burns of the first and second degrees are very painful, whereas in areas of third-degree burns, on account of necrosis of the whole thickness of skin with its contained sensory nerve endings, there is little pain save at the borders of the area where the burn is not really third degree. In a given case often areas of all three degrees are present, but in general it is true that where the sole or all areas burned are of the third degree pain is usually absent or minimal.

Blood contained in the vessels of the burned area of the third degree

is coagulated and the precise depth of the burn can be determined by the level at which bleeding occurs on incision.

Prognosis.—This depends on many factors: the extent, character, and location of the burn, the age, sex, race, and physical condition of the individual.

It is usually stated that superficial burns involving one-half to two-thirds of the body surface are almost invariably fatal, whereas those involving one-third of the surface area are extremely serious. Qualifying statements are generally made to the effect that in children the effects are even more serious per amount of surface area involved and that burns about the face, neck and genitalia are of relatively grave significance. Burns about the face and mouth are apt to be associated *with* burns of the larynx and trachea, with the very serious possibility of ensuing edema of the glottis and larynx. (The onset of hoarseness with slight respiratory difficulty should cause the making of a tracheotomy opening to be seriously considered, for it is better to do a tracheotomy a little prematurely than too late. Fatal obstruction in such cases can develop rather suddenly.)

It has been found on careful study of many cases that the depth of the burn is also of importance in determining the prognosis. A general impression to the contrary exists. By carefully charting the measured burned areas of a series of cases according to both surface area involved and depth of burn, Weidenfeld found (1) that "burns of the second degree end fatally after a longer time than burns of the third degree of the same total surface area; (2) that burns of the second degree *involving the whole body surface* correspond with burns of the third degree involving only *one-third* of the surface of the body; and (3) that burns of the second degree covering one-third of the body are equaled in severity of results by third-degree burns involving only one-ninth or one-tenth of the body surface." (Such a disparity according to depth of involvement is not of universal observation among surgeons.)

The same author logically explains the mortality of infants in burns of relatively small extent, one-tenth or one-twelfth of the body area, as due to the disproportionately large body surface of the infant as compared with its weight; the surface area of the infant or child being comparatively three times as large as that of adults. Thus in a newborn infant a burn of the third degree of 400 sq. cm., corresponding to about one-twelfth or one-tenth of the total body area, is sufficient to cause almost certain death.

Treatment.—The rationale of treatment of superficial burns may be considered in its four important phases:

1. The prevention and treatment of "shock."
2. Eliminative treatment (forced administration of fluids).
3. The treatment of the local injury caused by the burn.
4. Prevention of contractures.

While all of these are important, the prevention and treatment of shock and the forced administration of fluids (cf. Underhill, *et al.*) would appear of greatest importance owing to the life-saving factors here controllable.

The mortality in severe burns is still capable of much improvement, even in series of cases handled in our better hospitals. Risley found a mortality of 25 per cent in records of 216 hospital cases studied, and believes that more interest and intelligent effort would do much to lower this mortality. Failure to appreciate, as he says, that *primarily one is dealing with a patient suffering from "shock"* and that the *application of a dressing is of secondary importance* has led to many deaths. To the above one can only add the *italics*. Further, every one must realize that for twenty-four or thirty-six hours in severe cases one may do much more harm by dressing such burns than by leaving them alone, save for the administration of morphin in sufficient quantities to keep the patient *comfortable,* and the forcing of fluids as indicated below.

More specifically: no burned patient who is in pain should be moved, to the hospital or elsewhere than the improvised first-aid station (in the case of fire disasters in our cities) before a generous dose of morphin is administered hypodermically. It is a paradox, of course, but it is doubtful if the importance of this is nearly so well appreciated by many physicians and surgeons in our great cities as it was in the dressing stations in France during the World War. (To facilitate the emergency administration of morphin it would seem advisable for every doctor to have in his bag the ready-to-use sterile injection unit solutions of morphin now available.)

On arrival at the hospital these patients usually are admitted through the "accident" or dressing room, where it is the customary procedure for an interne to examine them for the extent of the injuries and to apply dressings. This involves *exposure* of individuals often in shock, and infliction of additional pain, both causing a deepening of the state of shock. The enthusiasm of the average interne for dressing such cases immediately (due primarily to instruction or lack of it, and sometimes to actual hospital rules) is a wonderful thing.

Instead of stripping and exposing these patients to a room temperature of 65° to 75° F., what should be done is to determine whether or not shock is present, which is a matter of only a few moments observation of the pulse rate and quality, the body temperature, and the general reaction of the individual. The blood-pressure may be taken, if this is possible without hurting the patient or delaying in order to secure a blood-pressure instrument (but this is only necessary at this time in cases doubtful as to the presence or absence of shock). Only burns of limited extent should be dressed here, or wherever first-aid is given, unless of an exposed part, such as hand, arm, or face. In most instances it is better to play safe

for the patient's good and get him to bed, where warmth, comfort (narcosis), and institution of forced fluid administration are the principal prerequisites of treatment during the first few days.

The excitement which prevails during a large fire with injury by burning of a large number of persons is a serious factor in the proper first-aid handling of them. Once arrived at drug store or other improvised first-aid station, eagerness for dressing them immediately is manifested and if no doctor is at once available is apt to be undertaken by druggists or any one at all who first rushes in. One still retains a vivid impression of experiences on the night of a local theater fire in New Haven in 1921. The first-aid station consisted of a drug store almost immediately across the street from the blazing building. Here patients were still arriving, being dressed and thence transported to the hospitals as rapidly as possible. A supernumerary policeman, not in uniform but armed with his club, guarded the doorway against entrance of any save those he knew, or possessors of fire surgeon's badges, or those in the white attire of hospital internes or orderlies. Not being of his acquaintance, or arrayed as any of those, and foolishly attempting to enter, it was only the alertness of a medical student immediately behind me in catching the raised arm of the officer which prevented sundry effects to my cranium.

Having received sufficient morphin and having been put to bed, preferably in the hospital, the fire victim should be got warm and kept warm by application of blankets and external heat (electric pads, etc.). As soon as they can be obtained or extemporized, a "cradle" should be arranged so as to support the weight of the bedclothes and one or more electric lights suspended within the "tent" primarily for purposes of warmth. The patient's head, of course, should be outside the tent and heat within the latter observed from time to time to forestall effects of overheating. A thermometer should be hung inside and if rational the patient's own sense of comfortable warmth should have much to do with regulation of the temperature which usually should range from 100° to 105° F.

The use of the so-called continuous tub bath for extensive burns of the body is not of unqualified value. One or even two nurses or one nurse and one orderly are hardly sufficient help to keep the water at the right temperature unless a special type of tub is available. (Even tubs especially for the purpose with automatic heat regulation are not entirely reliable in our experience.) The suggestion of Davis Forster, of tubbing the patient for only one hour the first day in warm 2 per cent boric or normal saline solution at a temperature of 90° to 100° F., maintained according to the patient's desire and cooling when he seemed exhausted, would appear more reasonable. (In unconscious patients continuous tubbing seems unadvisable unless there is delirium, for which it may be highly efficacious.) The baths may be increased in length to three hours

per day, according to how the patient reacts. It is my feeling that if those who recommend continuous tub at 110° F. would personally experience the often exhausting effects of such a hot bath for a few hours this opinion would be considerably modified. As above suggested it will be found an extremely painstaking job to keep the water in an ordinary tub at a proper mean temperature, and harm probably often results from unavoidable extremes of temperature. The tubbing of single hands or arms, however, is very valuable treatment. This may be done during the day, and at night the part wrapped in oiled silk over wet dressings. This aids sleep and lessens edema and excessive sticking of the gauze.

Where tubs are thought advisable the room must be kept considerably warmer than otherwise necessary. The sheet in which the patient is supported (or special slings) should have an opening for use of the bed-pan when the water is temporarily withdrawn. The patient must be kept comfortable by means of morphin.

In serious burns there is usually some degree of "shock" present, the blood-pressure is lowered as a rule, the pulse rate accelerated, and the temperature apt to be subnormal. Two forms of psychic reaction are commonly noted. If one observes a "dressing station" filled with twenty or more sufferers from more or less serious burns all sustained at the same time, some may be seen to be giving evidence of extreme pain, while others are in an apathetic state although perfectly conscious. These constitute the so-called "erethristic" and "apathetic" forms. It can only be conjectured whether the apathetic form is not often the result of exhausting effects ("shock") of the experiences gone through, but such an explanation appears to be reasonable in many cases. *Practical* consideration of the reaction of the individual is of importance *because the more seriously burned individuals showing this apathetic reaction may not, in the rush of handling many cases, receive the prompt consideration they deserve.*

Aside from the pain and blood-pressure effects, the sufferer from burns of moderate to great severity soon shows other evidences of a definite disturbance of the metabolism. In addition to the possible presence of apathy, there may be hiccough or vomiting, indicating some involvement of the central nervous system. Anuresis is often present, or hematuria. In less severe cases the urine is concentrated and may contain some albumin. From the work of Underhill it would appear that these symptoms are not usually present in moderately severely burned individuals, provided they are given fluids in sufficient quantities.

It has long been known that an apparent increase in the hemoglobin, and both the red and white blood-cells exists, but Underhill and his coworkers have shown that this is due to a concentration or dehydration of the blood and have advocated the necessity of more largely increasing the fluid intake in these cases than has heretofore been appreciated.

The constitutional symptoms have been attributed to thrombosis,

shock, vasomotor changes or toxemia. The experiments of Klebs and Welti (Weidenfeld) with subjects of which autopsies showed numerous thrombi present in the various internal organs (principally, however, in the brain) were performed by dipping the ears of rabbits in hot water, which was not hot enough to coagulate the blood immediately. Sonnenburg's experiments seemed to support the importance of the factor of "shock." This observer caused extensive burns of the hind parts of rabbits and of dogs. The blood-pressure at first rose rapidly and then sank suddenly just as in shock. But when the spinal cord was first severed before infliction of the burn even when one-half of the body area was burned (in dogs), those in which the spinal cord was severed remained alive much longer than the control animals in which the nervous system remained intact.

Bardeen, after carefully studying the tissues of five persons on whom he performed autopsies, all of whom had succumbed within eight hours after the injury, concluded that a poisonous substance was present in the blood plasma. In autopsies made on cases dying later, cloudy swelling of the various viscera, minute thrombi throughout the same (Dorrance and Bransfield), duodenitis and occasionally duodenal ulcers of the acute type are found. (Dayton and Leonard reported multiple acute gastric ulcers in a patient autopsied following death within a few days after the Percy cautery treatment of cancer of the cervix uteri.)

Weidenfeld introduced weighed amounts of boiled skin of animals of the same species into the peritoneal cavity or subcutaneous tissue of other animals, and found that death took place when a certain amount of skin per kilo of body weight had been introduced, the rapidity with which death occurred depending on the amount of burned skin introduced. If the burned skin was introduced subcutaneously, the effect was the same provided the skin was introduced in various parts of the body, since, if it was introduced in one mass, absorption of its contained poisonous substances was not so rapid. The skin used was boiled only momentarily; if prolonged boiling was used, the toxic material apparently was destroyed and the animals in which the material was placed survived. The result also was negative if the scalded skin was extracted by washing under running water before being placed in other animals. (Little note has been made of Weidenfeld's work in this country.)

Dorrance and Bransfield quote the experiments of Salvioli, Markusfeld and Steinhause, who found that if the ear of a rabbit is burned, the blood supply having been previously cut off, little constitutional disturbance results. If the blood supply was left intact, even though the nerves were severed, severe constitutional effects resulted. Cannon has demonstrated that toxic substances in the circulation played an important part in the production of traumatic shock by crushing the muscles of dogs and immediately applying a tourniquet. Shock was delayed until the latter was

removed, or occurred at once if a tourniquet was not applied. This work of Cannon followed the observation during the war of similar effects in the human following crushing injuries of the limbs.

Dorrance and Bransfield noted a marked increase in the first three or four hours in both the red blood-cells and the leukocytes with hemoglobin figures as high as 120 and a shortening of the coagulation time to as low as two minutes (Dorrance-Bransfield coagulometer). These observers used the blood picture for prognostic purposes to the extent that, when the red blood-cells were found to be over 10,000,000 and the leukocytes over 50,000, death was considered to be imminent.

It remained for Underhill and his coworkers to determine more accurately the extent of these "blood concentration" changes, offer a rational explanation for them and, most important of all, to point out the importance of forcing the body fluid intake to levels commensurate with the degree of blood concentration, an extremely important contribution to the therapy of extensive superficial burns.

These observers carefully studied the changes in blood concentration in a comparable series of 21 cases of extensive superficial burns, all sustained at the same time, by accurate gasometric determinations of hemoglobin. They found that the blood soon becomes highly concentrated and concluded that patients with a hemoglobin percentage of 125 per cent of the normal value are in a dangerous condition, whereas if this percentage has risen to 140 or over death is imminent unless this concentration is rapidly reduced by energetic forcing of fluids, thus lowering the blood concentration. According to Underhill, the concentration is effected by the loss of serum which is exuded both on to the burned surface and into the tissues of the burned areas where its presence is manifested as an edema.

From what one has been able to gather from the literature of treatment of extensive superficial burns, the extent to which the forcing of the fluid intake is necessary has never before been appreciated. The work of Underhill points the way. In general, from 4 to 8 liters per twenty-four hours should be administered, by mouth preferably, but by rectum, subcutaneously, or even intravenously if necessary. Cases treated in this way show a marked lessening or absence of the usual toxic symptoms of delirium, etc. These authors illustrate the importance of the administration of an unusually large amount of fluid by report of a case, a victim of the same fire who was being cared for at home by his own physician. Special attention to forcing of fluids was lacking. The patient was very badly burned and showed the usual symptoms of intoxication from burns, chief among which was an active delirium, restraining measures to keep the patient in bed being necessary. After determining the hemoglobin value to be 163 per cent (about 148 per cent of normal), 2 liters (2,000 c.c.) of 0.7 per cent sterile sodium chlorid solution was

administered subcutaneously. A few hours after the salt solution had been given, the patient regained consciousness, became rational and co-operative in the taking of fluids, and eventually recovered.

The only hindrance to the carrying out of intensive hydration therapy as indicated by Underhill is that according to this author the hemoglobin determinations of the blood concentration should be most carefully done by the gasometric method of Cohen and Smith. While such determinations would be of great value in estimating the gravity of the case and the urgency with which fluids should be pushed, it would appear that where such method was not available one could approximate the desired result by raising the fluid intake in adults to between 6 and 8 liters of fluid per twenty-four hours, according to the gravity of the case.

The question of the advisability of transfusion of blood as a preventive or therapeutic measure in extensive burns has been advocated from time to time (and more recently by Ochsner). It would appear, however, from the work of Underhill that the indications are rather clearly for dilution of the highly concentrated blood to its normal state of volume (and fluidity). There is no appreciable loss of blood cellular elements, but a great loss of blood plasma, so great that the circulation is seriously embarrassed for lack of normal blood volume to work with and by actual thickening of the remaining volume of blood.

After some consideration of the above-noted work (Underhill *et al.*), it would seem that previous theories regarding the influence of toxic substances in the blood are not necessarily shaken, but that mechanical difficulties caused the circulatory mechanism by the highly concentrated blood have now been recognized and a rational mode of therapy deduced therefrom which seems to be highly effective in so far as it has been carefully carried out. No one can say that the dilution and elimination of toxins from the burned areas is not a factor in the good results of the superforcing of fluids in these cases, but this uncertainty is only an additional reason for the employment of the method.

The problem of other "shock" or "shocklike" conditions is now open to a new angle of attack by the establishment of the importance of blood concentration changes in various conditions by Underhill and his co-workers. High blood concentration means loss of blood volume together with the presence of blood changes in fluidity. The latter factors depend upon the blood concentration and may interfere so seriously with the circulatory mechanism that a marked lowering of blood-pressure results.

One is not entirely convinced that a high blood concentration is solely responsible for the picture of shock in burn cases. The factors of fear, pain and exhaustion certainly are of importance in some cases. (The influence of sensory impulses would appear to be important from the experiments of Sonnenberg.)

It would seem important to study the blood concentration changes in

severely burned individuals, beginning immediately after admission to the hospital. Such studies might add much to the work already done and it would also appear very important for such studies to be made in other conditions of clinical shock.

After what has been said concerning the prevention of shock and the systemic treatment by administration of very large amounts of fluids, it may be realized that after all the *local treatment* is of relatively minor importance so far as the actual prevention of loss of life is concerned. In the first few days in serious cases it is sometimes more important for the patient not to be dressed than to have dressings done. This applies especially to patients who have been or still are in shock. Risley speaks of cases which arrive in only moderate shock and do well under antishock measures but go bad shortly after the primary dressing or die in the course of a few hours with very definite shocklike symptoms. (Such cases may be recalled by many surgeons and physicians.)

Whatever may be said against the use of continuous baths, it must be admitted that it is very helpful at times to place the patient temporarily into a comfortably warm bath for the purpose of aiding the removal of adherent clothing or dressings. This can be done conveniently with children. (It may be again stated that it is unnecessary to detach adherent clothing on admission of seriously burned cases. So far as asepsis is concerned, such clothing has probably been rendered sterile throughout its thickness by the heat, especially if dry heat was the agent.)

The *picric acid* treatment of burns has strong advocates and it is a very useful remedy in limited burns of the first or second degree. It is applied on gauze saturated in a 1 per cent solution with gauze bandage to hold in position. Its analgesic property and the fact that it may be left on for three to five days if there is no odor commend it. When removed an ointment dressing of boric acid ointment mixed with vaselin may be applied. (D'Arcy Power, cited by Da Costa).

Da Costa has uttered a firm word of caution against the use of picric acid in deep (third-degree) or extensive burns and mentions the case of a child in whom poisoning occurred after its use in a second-degree burn. The symptoms of poisoning are dark colored urine (carboluria), albuminuria, marked yellowness of the skin, diarrhea and fever.

The *paraffin* method is of especial value for treatment of burns about the face, neck and hands. Its advantages in the treatment of extensive burns of the extremities and body are doubtful. The paraffin preparation (those made in this country are apparently equally as good as the patented original French compound) is melted on a water bath and applied to the dried (application to a wet surface is more painful) surface by means of a special atomizer or a camel's hair brush (the latter is entirely satisfactory, the atomizers are difficult to keep in working order). Following the application of a first coating a thin layer of glazed sheet cotton

wool is applied and over this one or more additional layers of the melted paraffin. Over this gauze or cotton wool may be applied, and held in place by a light bandage, in order to catch the secretions which escape at the edges of the paraffin mask. The method is contra-indicated where much suppuration is present.

The formula of Lieutenant Colonel Hull for a paraffin preparation supposed to be somewhat similar in composition to "ambrine" (the original French product) is given by Da Costa:

Resorcin	1 per cent
Oil of eucalyptus	2 per cent
Olive oil	5 per cent
Soft paraffin	25 per cent
Hard paraffin	67 per cent

Tetanus antitoxin in prophylactic dosage of fifteen hundred units for adults and equivalent dosage for children according to weight should be administered on admission or within a few hours thereafter in cases of third-degree burns. Dorrance and Bransfield advocate its administration routinely in all cases on account of the possible occurrence of tetanus as a complication.

Where available, gutta-percha tissue in thin sheets (rendered sterile by previous soaking in antiseptic solution as it will not stand boiling) possesses many advantages in extensive burns over gauze dressings. The tissue may be cut in any size desired and may be applied alone or with its under surface coated with boric or other ointments. Removal of such dressing is practically painless, as the skin, etc., does not adhere to it.

Wet compresses are excellent but too painful for practical purposes in the early stages of extensive burns.

So long as the burned patient is seriously ill, the most comfortable position of the injured parts should be allowed regardless of the eventual possibility of contractures. However, minor points even in the early course, such as avoiding approximation of burned fingers in order to prevent "webbing," may be attended to. But no painful posture should be insisted on until the patient is "out of the woods" so far as the general condition is concerned.

As soon as the patient's condition will warrant it and the granulating surfaces are healthy, they should be skin-grafted under local or general anesthesia (preferably the former save in infants or small children), by some one skilled in the technic. Reverdin or Thiersch grafts from the patient's healthy skin should be used according to choice of the operator, but the percentage of takes is higher in the smaller grafts where the field is not absolutely sterile. This matter of early skin grafting is sometimes important in saving the life of the patient, as in cases of extensive burns in which the acutely dangerous period is past, but a seriously

weakened individual is left with extensive more or less infected granulating surfaces. Sometimes such persons die after several weeks from neglect of the skin-grafting procedure.

It is now well known that the process of contracture in a wound practically ceases after epithelialization of its surface. This fact makes the early skin grafting of any save very small or superficial areas imperative if deforming contractures are to be prevented.

HEMORRHOIDS

Introduction.—This frequent ailment of man has been known through all the ages for which we have written records. Biblical commentators, as quoted by Tuttle and Gant, agree that it was this affliction which was visited upon the Philistines, who had taken away the ark of the covenant. Furthermore, the Philistines, in returning the ark, sent with it a "trespass offering," as suggested by their high priests, of "five golden 'emerods' (hemorrhoids) and five golden mice." So far as one knows, this is the only recorded instance of the display of hemorrhoids in a religious procession.

While the term "hemorrhoid" is favored in present-day usage, *descriptively* it is perhaps less accurate than the word "pile." The former, from the Greek, meaning "flow of blood," whereas the word "pile," from the Latin *pila,* a ball or swelling, connotes the condition as it more often exists; one realizes that, after all, hemorrhage is relatively rare in relation to the widespread prevalence of the condition, one authority stating that the majority of males are affected by the age of fifty.

While assumed to be more frequent in the male, this is open to some doubt as the female is less apt to subject herself to examination and also may frequently attribute slight hemorrhoidal bleeding to the menstrual function. Tuttle quotes Bodenhamer as stating that a sort of compensating mechanism exists in the female sufferer from hemorrhoids, the latter condition becoming apparent in the premenstrual days and subsiding coincidently with the menstrual flow.

Anatomy and Etiology.—Hemorrhoids develop from vessels of the hemorrhoidal plexus of veins, which is made up in large part of branches of the superior hemorrhoidal veins which form the beginning of the inferior mesenteric vein, a tributary of the portal vein. This plexus surrounds the lower rectum (anal canal) stopping just above the mucocutaneous border. Thus internal hemorrhoids are developed from the superior hemorrhoidal vessels.

The hemorrhoidal plexus is drained below the mucocutaneous junction by the inferior hemorrhoidal veins; hence external hemorrhoids develop

from the latter which normally drain into the internal pudic vein, a tributary of the internal iliac vein.

Hemorrhoids do not develop from the middle hemorrhoid vein which drains the plexus formed by the superior hemorrhoidal vein at a point rather higher up than the site of origin of internal hemorrhoids and thence joins the internal iliac.

The maximal number of internal hemorrhoids is said to be eight.

The absence of valves in the portal and hemorrhoidal veins, together with the erect posture assumed by man, constitute factors of prime importance in the development of hemorrhoids. Quadrupeds are said not to suffer from piles. For practical purposes it is unnecessary to enumerate all the causative factors in the development of hemorrhoids. These are usually grouped under predisposing and exciting causes. Excluding the instances of hemorrhoids which occur secondary to obstruction of the flow of blood in the portal system caused by organic disease of the liver or heart, pregnancy, or abdominal tumors, one can say that the most important factors are concerned with the absence of valves in the hemorrhoidal and portal veins, which, associated with the erect posture peculiar to the human, results in a considerable hydrostatic pressure effect. When in addition the occupation and habits of the individual conduce to constipation and much standing on the feet, little else may be needed. The disease is much more common in middle age and excesses in eating, drinking and venery, which are most frequent at this time, are contributory factors.

Pathology.—The essential facts here are concerned with dilatation of the veins and inflammatory changes involving the tissues outside the vein wall. There is no pathological evidence that inflammatory changes precede dilatation of the veins. The inflammatory changes are usually of a chronic character and may be closely associated with the formation of thrombi in the veins. Again the inflammatory elements are of the usual type seen in chronic conditions but occasionally, as in strangulated hemorrhoids, necrosis may add an acute phase. The so-called inflammatory hemorrhoid is merely one which is in a state of inflammation.

Among the chronic inflammatory changes should be noted, however, the increase in connective tissue which often occurs to some extent both in true hemorrhoids and in the so-called skin tabs outside the anus which have lost their vascular characteristics.

Classification.—According to location hemorrhoids are usually grouped under three varieties, which with a few of the synonyms and qualifying terms are as follows:

External—or cutaneous, visible on inspection of the anal region. This variety is covered with skin. The so-called skin tab or skin tag, however, is non-vascular and not a real hemorrhoid.

Internal—covered by mucous membrane, often invisible on inspection

of anal region unless some means is employed to cause them to prolapse. Neither can this variety often be palpated by the examining finger unless thrombosis or fibrosis has occurred.

The *combination* type in which features of both the external and internal varieties are present, hemorrhoids being present which are covered both by mucous membrane and skin.

The term "itching piles" so often used by the laity refers to instances of *pruritus ani* associated with hemorrhoidal diseases but not necessarily dependent upon the hemorrhoidal condition.

Constitutional hemorrhoids—a term employed to designate those dependent upon some organic disease of other organs, such as cirrhosis of the liver, or cardiac insufficiency.

Bleeding hemorrhoids or *open piles* are terms applied to any variety from which there is loss of blood. The designation *inflammatory hemorrhoids* may be similarly applied to any variety when in a state of inflammation, but is usually meant to designate such a condition occurring in instances of external hemorrhoids.

Diagnosis.—The diagnosis of hemorrhoids is usually considered to be so obvious that many other complicating conditions are treated under this diagnosis by men who do not take time to make a careful examination. Partly on this account and partly because hemorrhoids often complicate other more serious rectal diseases, such as carcinoma and stricture, the diagnosis of hemorrhoids is sometimes made without a sufficiently thorough examination to enable one to arrive at a correct estimation of the existing status. On the other hand, one has seen a patient sent to the hospital almost exsanguinated by bleeding from hemorrhoids accompanied by a diagnosis of bleeding gastric ulcer. (The blood was dark but not tarry.)

Internal hemorrhoids are not usually palpable on digital examination of the rectum and unless prolapsed at the time of the examination the patient may have to take an enema and be examined before the prolapsed piles have returned into the anal canal. A Bier suction glass can also be used to draw down the hemorrhoids.

Proctoscopic examination should be made where there is any possibility of complications or in any case before treatment is instituted. If the latter is to be done under local anesthesia such (proctoscopic) examination may be made just prior to the treatment and after the establishment of anesthesia.

Every practitioner who deals with these cases should possess or have access to a proctoscopic set and be familiar with its use, although its most refined employment is often impossible save in the specially equipped examining room. Enough may be accomplished, however, to avoid many grave errors and the new knowledge acquired by special study of one's cases in this way is a great satisfaction aside from the benefit to the

patient. Although diagnosis and treatment of diseases of the upper rectum and sigmoid may be beyond the ken of the general practitioner, the fact of the relative enormous frequency of diseases of the anus and lower rectum and the much greater ease with which examinations here may be conducted makes the familiarity with such methods very important.

Fissure in ano is one of the most interesting conditions encountered in this field. Although the pain of fissure in ano is practically a household word in medicine, on first encountering such a case, or more vividly by personal experience, one is amazed at the extreme aching character of pain ("sphincteralgia") experienced.

This condition illustrates the usually greater pain incidental to benign conditions as contrasted with the absence of pain in incipient or even well-advanced malignancy. It is pain which most surely forces the patient to seek relief and it is a considerable misfortune that the conditions are not reversed. If early cancer were painful, how many more persons would apply for treatment early in the disease!

In the male the fissure is usually posterior directly in the midline and commonly there is a cutaneous pile directly below it. The oval or racket-shaped defect in the mucosa of the anal canal may be seen beginning just above this so-called "sentinel" pile and extending upward for one-half to one inch. On account of its low situation, it may sometimes be seen with the patient in dorsal decubitus on separating the buttocks widely and instructing the patient to bear down. In the female fissure is more often located in the midline anteriorly. Even in this condition use of a Sims' speculum or a Kelly anoscope is indicated in order to detect the presence of not infrequently complicating conditions, such as internal hemorrhoids, submucous or other fistulæ, polypi, and hypertrophic papillitis (which appear as small upstanding polypi in the anal canal below the anal crypts).

As Stone says, a good examination should be made in every rectal case before treatment is instituted, and a good examination requires "a firm table, a good light, best the knee-chest position, and in most cases a proctoscope, plus a trained and experienced examiner." It is often possible, however, to make satisfactory examination of the lower rectum with the patient in the Sims' lateral position or in the dorsal "lithotomy" position. The knee-chest position is not relished by the patient, and an unusually broad and stable examining table is necessary for it.

Non-operative Treatment.—The above-quoted author has summed up this matter thus:

"None but the most enthusiastic operator will deny the existence of a very large number of cases in which palliative measures are quite sufficient. These measures consist in securing regular soft bowel movements, avoidance of straining, and the local use of ointments or suppositories containing mild astringents and sedatives."

The same writer specifies the indications for operation as follows:

"First, hemorrhage, rare and slight bleeding may be no reason in itself for operation, but persistent slight bleeding, or occasional free bleeding, or regularly recurrent moderate bleeding are all sufficient causes for operation. Second, protrusion, the constant eversion of redundant tissue causing interference with cleanliness, tendency to thrombosis and ulceration, and general discomfort are reasons for surgical removal. Third, pain. Hemorrhoids when uncomplicated are not painful. Pain means the onset of thrombosis, ulceration, abscess or other complication that in itself needs surgical treatment."

As suggested above the presence of hemorrhoids does not necessarily mean bleeding, protrusion, or pain and one may have them for years without knowing it. Aggravation of the condition with or without definite complications usually results from constipation. Once the condition has become bothersome, constant care on the part of the individual with occasional examination and advice by the physician or surgeon in charge is usually necessary to prevent further progress and perhaps troublesome complications.

Just as in other conditions in which the question of palliative or non-surgical treatment *versus* surgical measures is debatable, so also here in each case the individual's status in the economic scale, his habits, environment and vocation often determine the treatment to be employed. Operation is of course contra-indicated on account of coexisting serious constitutional disease, in very old or frail persons, and in those who refuse operation. The carrying out of palliative measures, especially in well-advanced cases demanding active treatment, may consume more time than can easily be expended in the individual case, but on the other hand the simple measures required in numerous cases which respond well to palliation may be more desirable than operation, depending on the individual. For example, a workman will lose much less time in the space of a few years with the four or five days' confinement necessary for operation than with the carrying-out of some of the palliative forms of treatment which are advised, whereas one with more leisure may not mind the necessary daily care.

For the mild cases which get along with relatively little discomfort so long as regular soft bowel movements are secured, one would advise only the mildest of measures necessary to secure this result. If it is necessary to resort to something in addition to a diet with high vegetable content, fruit adjuncts (prunes, etc.), together with the drinking of plenty of water, and moderate out-door exercise, the employment of mineral oil may be sufficient. Many persons object to taking it on account of the possibility of seepage, which if once experienced is apt to make the patient quite wary of it. However, this difficulty is entirely a matter of dosage and must be determined by the individual. Of course when the treatment

is instituted during a period of constipation it may be necessary at first to use a laxative in addition to the oil.

In children constipation must be constantly guarded against and here especially the use of mineral oil should supplant the use of cathartics and laxatives of various kinds save in unusual cases, and in these it is better as a rule to use an enema. Only if there is fecal impaction or a spastic sphincter would it seem necessary to use the suggestion of Drueck concerning dilatation of the sphincter in children. It is most important to eliminate candy and pickles from the diet and overeating in general must be avoided. A relatively large amount of vegetables should be allowed.

Concerning the use of enemata, authorities are agreed that cold water enemas are superior to those of warm water, which congest the parts and tend to leave the hemorrhoids more distended than before. These are recommended in mild to moderately advanced cases as an effective means of combating the tendency to congestion.

Individuals applying for treatment, however, usually do so on account of the presence of some complication, strangulation, pain, bleeding or uncomfortable protrusion, usually leading them to seek advice.

If the hemorrhoids are *prolapsed,* with or without inflammation, and whether or not they are said to be "strangulated," one must reduce them, and this should never be attempted in any other than the knee-chest position or some slight modification of it. A wide-legged chair may be placed in bed tilted forward and the patient placed prone over the chair-back with head down the incline. Also instructions are given to relax, and to effect this as completely as possible he is told to breathe deeply with the mouth open. Having put on rubber gloves, the physician often may reduce the mass of hemorrhoids without using any anesthesia. With plenty of lubricant on the fingers gentle pressure is first made for a few minutes which may slightly relax the constricting sphincter in addition to aiding the draining away of blood from the region. The hemorrhoids are now reduced, not *en masse* but by gently pushing in first one, then another, using the fingers of both hands in somewhat the same way that the surgeon occasionally does to reduce coils of intestine into a poorly relaxed abdomen during a laparotomy. It may be found that the hemorrhoids reduced bob out a moment later, but by persisting in this maneuver for a few minutes reduction in most instances of strangulation can be effected.

Occasionally it may be necessary to paint the mass with 4 per cent cocain in 1 : 1,000 adrenalin and then wait for twenty minutes for absorption to take place, as suggested by Drueck. The latter writer cautions against reducing any part of the mass which belongs external to the sulcus which may be found running parallel with the median raphé of the perineum. In other words, do not try to put into the canal more than belongs there.

After reduction of strangulated hemorrhoids one of the astringent

ointments may be applied and the patient should lie prone in bed with the hips elevated on one or more pillows. If the prone position is not tolerated the Sims' posture with a pillow under the nether hip must be adhered to. These positions tend to reduce the local congestion by gravity and thus militate against recurrence, prolapse and strangulation. In addition some authors recommend strapping the buttocks together with adhesive as an additional safeguard. The lateral position with elevation of hips should be encouraged for at least two days in cases of severe strangulation.

As stated by Tuttle, the cardinal principles in the palliative treatment of hemorrhoids consist in the prevention of prolapse and the arrest of *hemorrhage*. The latter is the most alarming complication to the patient. Complete rest in the horizontal position with the hips raised, aided by morphin to quiet the patient (and thereby to aid in keeping the blood-pressure down), and liquid diet will often suffice alone. The bowels should not be moved for about three days and then cautiously, first giving an olive or mineral oil enema of a few ounces through a *small catheter* instead of the conventional rectal tube. Most authors also recommend cold applications, injections of hydrastis, tannic acid and krameria (Tuttle). Gant, while inclined to operate at once for hemorrhage, points out the fact that most rectal hemorrhage is from points within the anal canal which can be easily and effectively packed with gauze if necessary. Very rarely individuals may be encountered in such a state of blood depletion that transfusion from a suitable donor should be availed of as a precautionary or actually life-saving measure, particularly if a radical operation is contemplated.

Prevention of prolapse is concerned with the proper regulation of the bowels (see under method of Lyth), certain dietary restrictions, particularly for alcohol, tea, coffee, tobacco, sweets and carbohydrates, and advice as to moderate outdoor exercise, such as walking and the milder athletics according to the age and physique of the patient.

Certain special forms of hemorrhoids deserve particular reference, which will be made now and finally some account given of more active palliative measures.

Clinically *thrombosis of external hemorrhoids* appears in a rather characteristic manner; a slight pain like a pin prick or a sense of something giving way occurs while the patient is straining at stool or engaged in heavy work or exercise. Tuttle states that these symptoms are accounted for usually by rupture of a varicose external hemorrhoid vein with subsequent clotting of the extravasated blood and also of the blood in the vein. The process of thrombosis is associated with pain of an aching or throbbing character which gradually lessens in twelve or twenty-four hours, save in those instances in which the thrombotic mass is wholly or partly beneath the mucocutaneous margin, in which case the pain is more acute,

owing to irritation of the sphincter, making defecation and sitting quite uncomfortable.

The resulting small swellings caused by thrombosis of external varicosities appear as small bluish tense nodules from pea to walnut in size. Although these swellings may be absorbed, become encysted or organized (fibrosed), and later calcified, the danger of infection is great owing to the proximity of the bacteria-containing glands of the superimposed skin. According to an excellent authority (Tuttle) many perianal abscesses and fistulas originate in this manner (the presence of broken down blood-clots in a perianal abscess definitely indicating this origin) and no other treatment is warranted than immediate evacuation of the clot through a small incision. This may be made at the office or home under local anesthesia, freezing with ethyl chlorid or injection of novocain. The resulting wound should be left open to heal by granulation, which, as a rule, occurs in a few days. Simple aseptic dressings should be employed with a T-binder which can be improvised with a roller bandage.

Inflammatory external hemorrhoids, also called edematous piles, occur as a result of infection from associated pathology, such as fissure in ano, anal or rectal ulceration, chancroid, and also quite frequently from traumatism or direct injury of various sorts. The inflamed mass occurs in one of the folds of the perianal skin and is responsible for pain very similar to that of thrombosis save that the onset of pain is more gradual. In appearance there is not the blue color associated with the thrombotic variety, but they usually appear as red or pink masses radiating from the anus, being either single or multiple, firm or semifluctuant on palpation but very painful to the examiner's touch. Careful examination should be made on account of the possibility of complicating factors.

Palliative treatment is often successful in this condition, if uncomplicated, and should consist of such measures as elevation of the hips and application of an ice-bag to the parts. It is better to keep the ice-bag applied only at intervals on account of the possibility of sloughing from this cause. It may be kept applied for fifteen minutes to a half hour, followed by removal for a similar interval. If there is difficulty in controlling the pain, the following ointment (Tuttle) may be of material aid:

℞	Morphin Sulph.	gr. v-x
	Ichthyol	ʒ iv
	Ung. Belladonnae }	āā ʒ i
	Ung. Stramonii }	

Sig: Apply two or three times a day.

Following the treatment outlined the process usually subsides, leaving in its place a cutaneous hemorrhoid, the so-called skin tab or connective tissue pile which is without symptoms save when inflamed. Fistulæ are

not apt to complicate inflammatory external piles even if suppuration ensues because the process is entirely external to the anal canal.

The method of J. C. Lyth (1921) consists of the intensive use of an astringent powder together with careful regulation of the bowels in order to obtain nightly preretiring defecatory habits. This last is a point of considerable value. He applies his plan of treatment to patients subject to prolapse of internal piles with such good effect that only as a last resort has he had to recommend operation in the past three years. In résumé the treatment is as follows when applied to a severe case of prolapsed internal hemorrhoids, "agonizingly tender," bleeding at times during defecation, and with constant discharge of blood-stained mucus:

Invariably the bowels must be moved (by suitable aperients) *the last thing at night before retiring.* However, a loose action or diarrhea must be avoided by care and discretion in the use of aperients.

After the bowel movement each night the parts are gently sponged with tepid water and *calamine powder* is thickly applied by placing a couple of drams on a sanitary cotton wool and gauze pad and on the exact part of the pad which will remain in contact with the piles. The pad should be pulled firmly up into position and the tapes tied about the waist.

Each morning the pad should be changed as above if there has been much discharge. If at first there is too much discomfort *unguentum hammelidis* should be worn on the pad during the day and this will surely have to be done on account of pain if the patient is so unfortunate as to have to have a movement of the bowels during the day.

In two or three weeks the piles will have become sufficiently shrunken for the daily pad to be omitted save in case of ill-timed defecation during the day. This shrinkage is attributed largely to the astringent action of the calamine powder.

After a further course of two or three weeks, any prolapse which occurs during the preretiring bowel movement is easily reducible, or even reduces itself on assuming the recumbent position. The patient is now progressing satisfactorily but should continue the régime and have *pulvis calamini* available.

The habit of regular nocturnal actions of the bowels will go far to prevent any further prolapse of such piles as may remain in the rectum, because it allows the immediate assumption of the recumbent position for many hours and also because it is the persistence of the partial prolapse which normally occurs in defecation which has done much to produce the condition for which treatment was undertaken as outlined above.

It is stated by Lyth that the method shortens to one or two months what nature may do in one or two years.

The advantage lies in the avoidance of any operative or quasi-operative procedures; as for the disadvantage, consumption of time by a more or less prolonged rectal serfdom is so obvious as scarcely to call for comment. Certainly it would seem that this is a palliative method of the purest sort and that following it recurrence is very liable unless the régime of nightly preretiring defecation can be carefully adhered to. The hemorrhoids are not removed or destroyed but merely reduced in size and perhaps "anchored" by some degree of fibrosis.

Concerning Local Anesthesia.—It is difficult to record more than the simplest measures of palliative treatment of hemorrhoids without encountering the question of local anesthesia which has come to the fore in recent years and is quite satisfactory in the operative treatment of hemorrhoid cases if properly employed. No great skill is required in its use, but a certain amount of familiarity with the technic and with the anatomy of the regional nerves and other structures is necessary. Since it is beyond the scope of this article to go into this in detail, one must urge the interested reader to secure a practical book on local anesthesia such as that of Allen or Farr (or the work of Gant) for consultation before attempting work of this character.

This reference to local anesthesia could scarcely be avoided in view of the fact that a number of the so-called "non-operative" methods of treatment either frankly state that local anesthesia is necessary or at least is necessary in the difficult cases.

With regard to this subject it seems advisable to urge the importance of one point. This concerns the solution to be used. Various solutions are satisfactory if properly made up, but the making up of solutions should preferably be left to the manufacturer or a registered pharmacist. Personally the former seems preferable and the ideal solution to use would appear to be one contained in a sealed sterilized ampule. Nor would I care to make up my own solutions. This word of caution seems wise on account of accidents which have occurred even in excellent hospitals due to employment of the wrong solution or of incorrectly prepared solutions. I have definite information concerning an immediate fatality in the outpatient department of a large hospital which resulted upon injection of a few cubic centimeters of solution supposed to be quinin urea hydrochlorid but which, upon investigation following an autopsy with negative findings, proved to be *10 per cent cocain*. Less dire happenings have followed the use of solutions made with *hypertonic* saline content, consisting of necrosis of skin (which regularly follows the injection into the epidermis of hypertonic NaCl solutions), with or without subsequent infection of the deeper tissues. The frequency of such occurrences may only be reckoned. A prominent surgeon and teacher once admonished me never to inject novocain into the epidermis for fear of necrosis. Subsequently I saw such results, which were determined by chemical analysis to

be caused by the use of hypertonic saline in making up the anesthetic solution.

This reference to injection into the epidermis leads to a final remark unnecessary to those familiar with local anesthetic work, namely, that to secure perfect anesthesia in *local* anesthesia work (as aside from the accurate *blocking* of regional nerves) it *is* absolutely necessary to inject the solution *into* the epidermis so that the line of proposed incision appears as a row of contiguous wheals.

The *injection treatment* for hemorrhoids has fallen into considerable disfavor on account of the bad results from injection of carbolic acid, particularly in the hands of quacks, so-called "pile-doctors" who advertise the cure of hemorrhoids without operation or disability. Gant mentions six instances in which death occurred directly or indirectly as the result of carbolic acid injection of piles. Of these he states that two died from secondary pulmonary infection, three others died within three days probably from embolic effects. The sixth case suffered from sloughing out of the rectum, rectovesical septum, and perianal skin, finally dying from exhaustion.

Such a European authority as Boas, long a user of the carbolic injection method, has now given it up and instead employs injections of 96 per cent alcohol. During four years' use of the latter injection method he claims to have treated fifty-two cases, with a "radical" cure obtained in all, and second injections necessary in only two cases.

The method as employed by Boas may be outlined as follows:

Preparation.—After examination of the condition by carefully drawing down all the hemorrhoids out of the rectum by means of a Bier suction glass, the patient is put to bed and given a purge, followed by a soapsuds enema on the following morning prior to the treatment.

Treatment.—Local anesthesia is used, followed by a wait of fifteen or twenty minutes, at the expiration of which time the patient assumes the knee-chest position and a Bier glass is employed to bring down well into view *all* the hemorrhoids ("injection of every pile in this method is essential to success"). Using a 10 c.c. glass syringe 2 to 5 c.c. of 96 per cent ethyl alcohol is carefully injected deeply into each of the hemorrhoids. Half of the amount may be injected into the upper half and the remainder into the lower half of the mass.

After the injection the mass should be returned into the rectum. This may be difficult if the mass is large and in rare cases a small part of the mass may have to be left outside of the rectum; "this delays the cure for a few days as the extra-anal portion will gradually slough off."

The patient must remain in bed in dorsal decubitus for four days after the treatment, receiving only a liquid diet. A purgative is given on the fourth or fifth day. If "prolapse" does not occur at the first stool it

will not occur afterwards, so that following the first defecation (without prolapse) a normal diet is resumed and the patient is allowed to be out of bed. About a week after the injection, the Bier suction glass is again used to see if the hemorrhoids are securely fixed within the rectum.

The surgeon may well object to the above that save that fewer instruments and perhaps less skill is required the procedure is practically as complicated as an operation (the "Whitehead" excepted, which, however, has been very rarely employed in recent years), the result of which almost surely would be more certainly curative. Special skill is necessary in the use of local anesthesia. However, the method may well be employed in cases where the patient refuses an "operation" but is willing to submit to confinement in bed for five to seven days and the carrying out of the above "non-operative" treatment, the word "treatment" being much less formidable than "operation," although there may be little difference in the magnitude of the two procedures.

Quinine urea hydrochlorid (1 to 5 per cent solutions) is also used in the injection treatment of internal hemorrhoids, in which protrusion and bleeding are the chief symptoms. One of the advantages of this drug are its prolonged anesthetic effects the area infiltrated remaining insensitive from one to several days. Rather more induration develops than after novocain and sloughing is more apt to occur. In the ambulatory treatment of hemorrhoids, with the above facts in mind, usually only one pile is injected at a time, other injections following at weekly intervals. Atrophy of the injected mass follows. On account of the possibility of sloughing the fluid should not infiltrate the mucosa of the anal canal but rather the individual piles. Its use is contra-indicated in inflamed, strangulated, or external hemorrhoids.

The electrolysis treatment has recently been strongly advocated by Webb for treatment of hemorrhoids of the prolapsing (so-called, "intero-external" or combination piles) variety. While the method may recommend itself highly to one familiar with electrolysis technic, for the average practitioner it would certainly seem too complicated, and other authorities are by no means in agreement with him as to the lack of pain associated with the treatment. It seems scarcely necessary to record its details here.

VARICOSE VEINS

(Phlebectasia; Phlebectasis; Varix)

Definition.—*"Varicose"* may be traced back to the Latin word *varus* meaning *bent.* Ordinarily the term *varicose veins* is taken to mean a permanently dilated vein, tortuous and irregular in form. Dilatation, however, is not invariably the rule, since through inflammatory and sclerotic

changes the lumen may be in places actually smaller than normally. *Varix* in its restricted sense connotes a localized dilatation of the vein wall, resulting in a sacculation; occasionally a walnut-sized protuberance covered by thin skin is referred to as a varix, whereas such a mass may at times be composed of a congeries of veins, some dilated, some constricted in places by kinking or thickening.

Applied Physiology.—Pressure in the veins of the lower extremity is determined by the height of the column of blood as modified by the action of the valves and (to a less extent) by the alleviation caused by the action of the musculature of the extremity which affords a supporting effect, and also, by alternately narrowing and enlarging the lumen during exercise, is said to exert a pumping action toward the heart.

Delbet (cited by Matas) has shown by actual cannularization of the varicose saphenous vein (under local anesthesia) a positive pressure of 16 mm. of mercury with the patient quiet, and a rise to 160 mm. of mercury on moderate exertion, and to 260 mm. (Hg) when a violent lifting effort was made. In a normal vein the pressure should be negative.

That the muscular support afforded the deep veins is of considerable importance would seem to be indicated by the rarity of varicosities of the femoral and other deep veins, a condition which, as Homans states, is very unusual.

Clinically it has been possible to demonstrate that the muscular support of the deep veins is an efficient mechanism particularly during certain forms of exercise. Thus it is known (Perthes, cited by Voeckler) that in an individual with varicose saphenous veins, if the saphenous be compressed below the groin so that its blood cannot enter the femoral vein at this level (the oval foramen in the lamina cribrosa), and the individual allowed to walk, the varices quickly subside (temporarily) thus permitting the conclusion that the act of walking favorably influences the centralward (centripetal) flow of blood in the deep (femoral) veins.

This action of the muscles upon the deep veins in walking, etc., has been termed the muscle pump mechanism. In operative attempts to utilize it directly in the case of varicose superficial veins, Katzenstein dissected the saphenous vein free and transposed it into the sartorious muscle. This procedure was followed by subjective improvement in that the affected limbs seemed lighter, but the varicosities below did not disappear.

The superficial veins are entirely without extraneous muscular support and it is these particularly which become subject to varicose changes. As noted above, involvemnt of the deep veins is very rare, but the communicating veins between the deep and superficial sets may undergo these changes. When this happens the condition is less amenable to treatment and tests have been devised to determine this question.

Lowenstein, in a study of normal veins, found that in young individ-

uals two frequent defects of veins occurred. In one there was defective musculature at the site of the valve sinuses, in the other a similar weakness existed distal to the valves. These defects he thought responsible for the later development of dilatations at or below the valve site. Treves (cited by Da Costa) explains the common occurrence of dilatation at points where the deep vessels join the superficial veins; at such points he says three forces meet: the blood column above, the valve below, and the force of the blood current. The vein wall dilates at the spot where the pressure is greatest and from here the current is deflected and causes another dilatation higher up and on the opposite side of the vessel.

Pathology.—Matas has said that the essential primary lesion is in the media of the vein as in arteriosclerosis. First there is hypertrophy of the muscular and elastic elements followed by atrophy and fibrosis. Pierce Gould thought that a predisposition to the growth of vein tissue is the fundamental cause and that this precedes incompetence of the valves and later changes. Fibrosis and atrophy of wall and valves associated with increasing hydrostatic pressure seem responsible for the further changes of elongation, tortuosity, and sacculation. Adhesion to surrounding skin or subcutaneous tissue is frequent in the fully developed condition and the overlying skin may become extremely thin so that slight trauma may cause dangerous hemorrhage.

Thrombosis may occur with subsequent formation of phlebolites associated with calcific infiltration. It is of interest that thrombosis of varicose veins is not so apt to give rise to emboli as is the same condition in a relatively normal vein. This is due apparently in great part to the retardation of centripetal (toward the heart) blood flow in the varicose condition.

A large protuberant varicosity (varix) may become a so-called "blood cyst" due to strangulation at its base. Often the thinned skin over such swelling transmits the bluish color from the contained blood, resulting in a characteristic appearance.

Etiological Factors.—The practical medical mind considers varicose veins chiefly as a resultant of occupations requiring long-continued erect posture with relatively little walking, as in the instances of clerks, washerwomen, cooks, and laborers. Likewise *mechanical obstruction* has received a prominent rôle; the gravid uterus, accumulation of fat in the foramen ovale, more rarely pressure from a large irreducible femoral hernia, abdominal tumors, etc., have been emphasized, but less so in recent years owing to the rarity of such association in comparison with the frequency of varicose veins. With respect to the condition of pregnancy it has been pointed out that here they may appear early before the uterus is much enlarged.

The hydrostatic theory is closely associated with the "erect quiescent posture" factor and seems of great importance. It has occurred to us

that physical fatigue may possibly play a rôle, through the vasomotor mechanism effecting a temporary loss of muscular tone of the valves and walls of the superficial veins, resulting in temporary valvular insufficiency. Often repeated the complete development of a varicose veins status might be established.

Gould's assumption of a predisposition to growth of vein tissue deserves serious consideration as an etiological factor and is rather similar in idea to Matas' dictum that "a congenital malformation or a dystrophy, involving the elastic and muscular layers of the veins, can alone account for this state." Whether one thinks only of a congenital weakness of the walls of the veins or a dystrophy, malformation, or predisposition to growth of vein tissue, it would seem that some congenital abnormality is necessary as a factor to cover those occasional occurrences of varicose veins in all members of a family and probably in some instances of the rarer development of varicose veins in the upper extremities. Of these latter some occur in laborers apparently as a result of excessive work in postures favoring the pronounced effect of hydrostatic pressure, while more rarely a congenital example occurs unilaterally. It would seem to be futile in this last instance to rule out the effect of abnormal intrauterine posture with pressure effects on the developing superficial veins.

Arteriosclerosis is often an important associated condition and indeed there is a marked similarity many times between the thickened venous walls and the process of arteriosclerosis. Hasebroeck in a recent publication, reviewed by Haubold, has put forward a theory which to the writer would seem of particular application to the cases of varicose veins associated with arteriosclerosis. As a result of experimental work with a model apparatus this observer convinced himself and some others that the entire theory of the causative influence of hydrostatic pressure is erroneous and that what occurs is an actual propulsion of the arterial wave into the veins, not only those adjacent to the main arteries but also those distant (that is, the subcutaneous ones). This would seem to imply a tremendous dilatation of the capillary bed and would appear to us to apply chiefly to instances in which there was a marked associated or primary factor of arteriosclerosis and hypertension.

Hasebroeck's theory may have received inspiration from the not often quoted work of Queirolo (cited by Matas in *Keen's Surgery*), who by careful manometric and kymographic tracings found that a constant hypertension exists in the arteries of varicose veins subjects. In those with unilateral varices there was a distinct difference in arterial pressure on the two sides. In individuals also studied after excision of the diseased veins the hypertension was found reduced to normal. His (Queirolo's) explanation of his findings assumed: "a local hypertonus (arterial) due to a secondary arteriosclerosis consequent upon the work of the artery in

overcoming the enormously increased pressure of the engorged veins when the valves have become incompetent."

Varicose veins also occur as a result of phlebitis, as a consequence of impairment of valvular competence by inflammatory changes. (It is worthy of note that very rarely they may be cured by similar inflammatory processes provided a permanent obliteration of the saphenous occurs.) We have seen an instance in which this had apparently occurred.

Incidence and Symptomatology—*Sex.*—Males are involved more often than females, Balfour finding a ratio of 3 of the former to 2 of the latter. Miller's series of 108 operative cases contained 57 per cent males to 43 per cent females.

Age.—The latter writer found that the varicose condition appeared before the thirtieth year in one-third of the cases and in two-thirds before the fortieth. Da Costa states that they usually appear between twenty and forty. The congenital type is very rare, but what appears to be a familial predisposition is not very uncommon.

It is only varicose veins of the lower extremities that we are interested in here, but, in passing, the occurrence of them in the lower end of the œsophagus, the rectum (hemorrhoids) and the spermatic cord (varicocele) may be noted. In order of frequency, varicose veins of the lower extremities come third, following in turn those of the rectum and of the spermatic veins.

Symptoms.—If there is no edema the patient may only complain that the legs tire easily on standing (or walking). If the condition is well developed and some edema is present a sense of weight and fatigue may be very pronounced. Actual pain is present at times due to involvement of accompanying sensory nerves. Pigmentation of the skin is commonly a residuum of subcutaneous extravasation of blood or small hemorrhages. Various complications, such as eczema, inflammatory conditions, ulceration or rupture, not infrequently are the cause of the patient first seeking professional care.

Complications.—(1) Thrombosis with its possibilities of pulmonary emboli, resolution or obliteration of the vessel by resolution; (2) phlebitis and lymphangitis, with or without thrombi; (3) erysipelas and cellulitis; (4) rupture, either external, subcutaneous or intramuscular; (5) varicose ulcer; (6) neuralgia, either diffuse or sciatic.

Thrombosis.—Thrombosis may occur insidiously without sufficient phlebitis to attract attention of either doctor or patient. While it is said that thrombosis of a normal vein is more portentous of embolism than thrombosis of a varicose vein, one recalls acutely two postoperative deaths from pulmonary emboli originating from unsuspected thrombi in varicose veins of the thigh. Both were in stout individuals in whom the veins, although varicose, were not easily seen. This experience agrees with Da Costa's statement that in thrombosis of varicose veins of the thigh

the chance of embolism is much greater than when the veins of the leg alone are involved.

Resolution of the thrombus may occur with restoration to patency of the vessel. More rarely the clot may organize and result in amelioration of the varicose condition below with actual spontaneous cure.

Phlebitis and Lymphangitis.—These not infrequently occur owing to the factors of trauma of the exposed veins, poor nutrition of vessel wall and overlying skin. The phlebitis is usually of the bland "plastic" or "toxic" character but occasionally is of a suppurative nature. In the latter case it is an extremely dangerous complication, usually associated with thrombosis and very prone to give off septic emboli into the circulation.

Lymphangitis is a frequent accompaniment of phlebitis, and not seldom the signs of one may be clouded by those of the other. Lymphangitis is coming to be recognized as a much greater factor in the production of edema than was previously suspected. The femoral vein and even the iliac vein has been ligated without the production of edema unless the lymphatics were occluded. Recently Halsted has ligated all the important veins and divided and resutured all the muscles of an extremity (experimental animals) without producing edema unless infection was present.

The importance of Halsted's work in this field should do much to elucidate this problem and will establish the fundamental importance of the lymphatics and of infection in edemata of various types.

Williams cites a case in which widespread thrombosis of the femoral vein on one side and all its branches (determined at autopsy) gave rise to an edema causing only a scarcely measurable difference in size of the two lower extremities.

At any rate clinically one sees instances of "thrombophlebitis" of the thigh complicating varicose veins in which there is redness, marked edema, a palpable cord running up to the groin, palpable and tender lymph-nodes, and, in such a case, if one will admit it, one may not be certain that one has palpated the vein or merely the zone of reaction surrounding the inflamed lymphatics (lymphangitis).

Erysipelas.—This occasionally occurs unaccompanied by or without more than a mild non-purulent lymphangitis or phlebitis. The prognosis depends on the general condition of the patient and the virulence of the infection, often serious as is the usual nature of the streptococcus, and especially since the soil in this instance is one of lowered resistance. The local lymphatics may carry the infection to the groin or farther.

Sometimes a cellulitis may develop involving the deeper layers of the skin and the subcutaneous fat. Such a condition may be an extension of an erysipelas or may only be preceded by trauma or a small furuncle.

Rupture.—Either external, subcutaneous, or intermuscular rupture of

varicosities may occur, from external trauma, increased intravenous pressure due to unusual exertion, or spontaneously as a result of gradual thinning of the walls of the varices. It is doubtful if rupture often occurs unless thinning of the wall has occurred, in view of the great pressures the vein walls have been known to withstand.

External rupture occurs most commonly over the crest of the tibia or in the vicinity of the malleoli. Hemorrhage may be very serious, due largely to the increased intravenous pressure. Subcutaneous ruptures are less apt to cause fatal hemorrhage, but may form large hematomata which may later become infected unless properly treated. Rupture of the deep veins between the muscles is much rarer. When it occurs spontaneously it gives rise to a sudden painful sensation compared by the French writers to a stroke of a whip, *coup de fouet,* or "whiplash." Ecchymosis appears subsequently in the course of hours or a few days.

Varicose Ulcer.—For a discussion of the various aspects of this condition see below.

Neuralgia.—A diffuse form of pain may occur due to the fact that each of the saphenous nerves is accompanied by a sensory nerve, and there is a second specific type of neuralgia due to the occurrence of intraneural and perineural sciatic varices. This is a definite entity for which operative relief (Quence) has been proposed and carried out. (However, this entity does not preclude sciatica of a less definite etiology occurring simultaneously with varix of the superficial veins.)

Diagnosis.—Only occasionally does the diagnosis of uncomplicated well-developed varicose veins elude the patient or his lay advisers before application to the physician or surgeon. This reservation of diagnosis in the uncomplicated forms may be due to the presence of obesity masking the subcutaneous varices, to the mild degree of disturbance experienced, or to the intelligence status of those concerned.

However, the complications are by no means so obvious in character, and even in uncomplicated instances there is certain information desirable, which can only be elicited by a skilled medical man, before the proper treatment can be decided upon. We refer to the tests detailed below.

As a rule the veins appear as serpentine bluish markings or elevations, in the region of the internal or external saphenous. The veins of the leg usually show involvement before those of the thigh. *Cavernous hemangioma* especially of the groin may offer difficulty in diagnosis but is very rare and, on careful examination, should be recognized. *Varix* in the femoral canal is sometimes mistaken for hernia but should be differentiated through the fact of disappearance by aid of gravity alone (Matas), as well as through the condition of the other veins. Such a varix may presumably transmit an impulse on coughing since varices of the spermatic veins (varicocele) do so quite plainly and have been mistaken for inguinal hernia. Occasionally a rather loosely lobulated lipoma of the groin or

thigh in a fleshy individual may resemble a mass of varicose veins, especially if the latter condition is present elsewhere in the limb. In *arteriovenous aneurysm* a palpable thrill and loud purring murmur are present and the involved veins are larger and transmit the arterial pulsation.

Tests.—If the valves of the communicating branches between the deep and superficial veins are incompetent, operation will afford very little relief. If the deep veins are thrombosed or obliterated by a previous phlebitis, operative occlusion or excision of the superficial veins may cause a permanent edema resulting in irremediable damage to the patient and possible unpleasant medicolegal eventualities for the operator.

An important practical indication as to whether the deep veins are involved is the relief obtained in wearing an elastic stocking. If this causes no relief then operation is contra-indicated (Mayo) as the deep veins are probably involved.

The Trendelenberg test may be performed in several ways; perhaps the simplest is as follows: With the varicose saphenous vein distended by posture compress the vein just below the groin, then by stroking the vein gently towards the foot it will be emptied, demonstrating the incompetency of its valves. By allowing the collapsed saphenous again to refill from above, and again emptying by stroking the vein toward the foot, we can satisfy ourselves that the deep veins are able to carry this additional burden and hence are not thrombosed. To ascertain the competence or otherwise of the valves of the communicating veins between the superficial and deep sets: empty the superficial veins by elevating the limb to an oblique angle or perpendicular to the body (patient recumbent), compress the saphenous below the groin, then lower the limb. If the superficial veins fill promptly, the valves of the communicating veins are incompetent; whereas if these are working properly the superficial veins will fill very slowly.

A quick finger tap (percussion) on the distended vein (patient standing) will be transmitted downward as an undulating wave palpable by the fingers of the other hand (Schwartz's test). Coughing causes a peripheralward impulse appreciable in some instances that is not present in the normal vein.

A word in résumé as to indications for rational operative procedures: In brief varicosity of the superficial veins of the *thigh* in addition to that of the *leg* indicates operation, as external pressure (elastic stocking) is much less effectually applied above the knee and as the condition is exaggerated when the thigh is involved. If thrombosis of the deep veins exists operation is of course contra-indicated. Even when the leg alone is involved, operation is indicated at times, especially when thrombi form, cystlike dilatations occur, or thin-walled veins cross the tibia (Da Costa and Bennett).

Non-operative Treatment of the Condition and Its Complications.—The principle reliance in the non-operative treatment is the adoption of some form of external support; of these, in cases without ulceration, the elastic stocking, properly fitting, is the best. When only the superficial veins below the knee are involved relief from the supporting stocking is very satisfactory. When the veins of the thigh also are involved and an elastic stocking for the whole limb is needed, it should be made in one piece, not in sections, otherwise it may cause actual harm (Da Costa).

Certain palliative measures deserve mention particularly for the early or slight case or for the more advanced condition occurring in individuals in whom operation is contra-indicated on account of some associated constitutional disease (although many of these may be operated on if necessary under local anesthesia).

The occupation is a great handicap to palliative measures if it necessitates constant standing. It is advisable for the individual to lie down for a time each afternoon if possible. If this cannot be done, it is quite helpful for the patient to sit with legs comfortably elevated and resting on table or window ledge (a position which Da Costa states is supposed to be peculiarly American). At any rate if long standing is necessary it will be found restful for the patient to walk as much as possible, even though his range of exercise be small. There is a definite indication for this in the muscle pump mechanism noted above and by means of which it can be demonstrated that the added centripetal effect caused by walking will permit the deep veins to empty the superficial ones, whereas in the quiescent erect posture the superficial varices remain distended. For similar and additional reasons graduated exercise in the open air is recommended and particularly that of bicycling is of aid.

The skin should be cared for by frequent bathing, with hot or cold water preferable to lukewarm. Garters and constricting garments should be avoided. The spiral puttee of the late War when improperly applied is thought to have had an unfavorable influence on the incipient condition. The use of a rubber pad or truss or any similar appliance used to compress the saphenous vein and prevent reflux from the great veins above is ineffective and not to be advised.

Various quasisurgical measures such as injection of 1 or 2 c.c. of 1 per cent bichlorid of mercury (Linser) into the involved area are not to be recommended. Thrombosis is caused and the vein obliterated. By-effects such as stomatitis, albuminuria, intestinal catarrh and sometimes severe pain have been reported with the method (D. Goldman). The author in using his method adopted the precaution of tourniquetting the limb and compressing the vein above and below the point of injection. Neither this nor the method of Koller-Aeby, in which after laying bare and excising small segments of the vein 1 c.c. of 5 per cent carbolic acid is injected, seems advisable. We can only condemn such procedures as

rash and unjustified. Aside from the dangers of phenol and mercurial poisoning, embolism via the communicating and deep veins would seem a sufficient possibility for positive contra-indication of the method. The method of Koller-Aeby would seem particularly to be censured because an inadequate open operation is performed.

Treatment of Complications of Varicose Veins of Lower Extremity.—When thrombosis occurs in a superficial vein, operation (ligation above and below and excision by dissection or stripping) is advocated (Da Costa) as the condition has some elements of danger. The occurrence of fatalities from this condition in patients recovering from operation for other presumably more important conditions would seem to emphasize the wisdom of Da Costa's opinion. When operation is refused or inadvisable from other cause, prolonged rest in bed is necessary with a minimum of motion in the affected limb for a period of two to six weeks, depending on the character of the individual case.

Phlebitis and Lymphangitis.—The treatment of phlebitis will depend upon whether the process is of the toxic or suppurative variety. If non-suppurative, conservative treatment may be instituted, consisting of constant rest in bed with elevation of the extremity to a comfortable oblique angle by means of props and soft pillows with cold application to the reddened areas—either cold compresses changed frequently or an ice-bag superimposed over a wet dressing. If cold is uncomfortable, heat (hot-water bag or compresses) may be substituted. At any rate warmth will be preferable as soon as the acute symptoms begin to subside and its effect is augmented by the use of flannel bandages applied snugly from toes to groin.

In the mild cases the patient should remain in bed until all swelling has subsided and if error is made it should be on the side of staying in bed longer rather than less than the above minimum time. Da Costa states that the sufferer from a plastic phlebitis should remain in bed from four to six weeks. The fact that one can seldom feel certain that thrombosis is not an associated condition should add to one's conservatism against early mobilization of the patient or his affected limb.

If the process is obviously a suppurative one, or if, in the course of the mild variety areas of softening (fluctuation) occur, prompt incision and drainage are indicated.

The treatment thus outlined for the acute stage of the non-suppurative type is less radical than that advocated by one of the foremost authorities (Matas), who says, "when infective phlebitis occurs, whether of the septic or non-purulent type, the proper course is to ligate the saphenous vein at the saphenous opening, in order to prevent the possible escape of an embolus from the thrombotic veins into the circulation. In favorable subjects this may be followed by extirpation of the inflamed veins."

It would seem to us that, in view of the occasional involvement of the

deep veins simultaneously with the superficial, without easily detectable evidence of it, one would not be unwise in delaying operative measures which, in the event of blockage of the deep veins having occurred, would result in deletion of all the main pathways for venous return from the extremity to the heart.

Even in the non-suppurative types one cannot be certain of the extent of the damage done until after all swelling has subsided and one can test out the patency of the deep set of veins.

Erysipelas.—This complication is treated by the usual methods employed with erysipelas elsewhere. There is really little that one can do to limit the infection save by endeavoring to aid the resisting power of the individual by general measures such as complete rest, increase of fluid intake close to the capacity limit, that is, from 5 to 10 quarts per twenty-four hours. Locally cold compresses frequently changed afford considerable relief. If the pain is severe, sedatives may be indicated. The local condition should be watched very closely for purulent changes in the deep tissues particularly; this may occur subsequent to a lymphangitis and lymphadenitis regional to the part involved. When suppuration occurs the area should promptly be widely opened and thoroughly drained.

The same therapeutic course holds in the case of a cellulitis which may migrate over a considerable area much as does an erysipelas, save that the subcutaneous tissue is more grossly involved. Heat is apt to be more satisfactory in this condition than cold and is, as a rule, very comfortable when applied as indicated above. Suppuration is more frequent than in erysipelas and some experience is required in determining just how much operative drainage is required. Here one had better explore an area and not find pus than to overlook it when present.

Rupture.—External rupture is the most common and most serious form. The bleeding can be controlled readily by local pressure, tampon and bandage, aided by elevation. The latter will usually control the bleeding alone if it is possible to maintain the limb at sufficient elevation. (Where rupture of a large vein has occurred in the cases suitable for cure by radical operation, the question arises as to whether to proceed with further operative procedures at once in order to effect a radical cure of the entire varicose condition. This depends upon the available surgical skill and operating room facilities as well as the physical and mental condition of the patient. If much blood has been lost, or the patient is in a hysterical state of mind it would seem better to wait. If the patient is seen promptly after the accident occurs, wound infection will scarcely be a factor under proper conditions of handling. However, since one is very likely to be ignorant as to the status of the deep and communicating sets of veins in most such cases it would seem wiser to delay operation.)

In the subcutaneous and deeper ruptures, rest in bed, elevation and

immobilization of the limb, and pressure bandage from the foot to the groin will suffice.

Varicose Ulcer.—See below.

Neuralgia.—In the mild diffuse forms the general measures for palliation of the general varicose condition will suffice. In the severe forms only operation will prove of much benefit, as also in the sciatic form due to intraneural and perineural varicosities.

LEG ULCERS

Introduction.—This is a condition for which much can be done in many instances by properly applied non-operative methods.

There are several varieties of *ulcus cruris,* of which the most frequent in this country are: (1) the *varicose ulcer,* which is the common form especially in the male; (2) the *lymphatic obstructive type,* which occurs particularly in women who have suffered from puerperal *phlegmasia alba dolens,* and as a sequel to *streptococcus lymphangitis* occurring in either sex; (3) the *syphilitic;* (4) *traumatic* forms, the next most usual variety, which is usually associated with more or less severe infection ("sepsis"). Other less frequent types encountered in both sexes are: (5) the *tuberculous;* (6) the *eczematous,* or *postpsoriasis* ulcer; (7) the *malignant* forms of ulcer; (8) the *perforating ulcer* (*mal perforant*), which usually, however, occurs on the foot.

Various classical designations found in the literature apply as a rule to one of the above varieties or to minor variants of them. Thus we hear of the "erethistic," "irritable," or "painful" ulcer, which is associated with exposure or inflammatory involvement of nerve sheaths or filaments, the "callous" (not infrequently applied to *mal perforant,* the "hemorrhadic" and the "edematous" ulcer.

Of the *malignant* type there is that arising as an *epithelioma* associated with previous *chronic* ulceration or an old scar, usually termed "Marjolin's" ulcer; sometimes following burns as in the "kangri" ulcer of the abdominal wall in the natives of northern India (Kashmir) who for warmth carry a charcoal fire contained in a wicker-surrounded earthenware pot, slung from the shoulders against their abdomens beneath their loose-fitting garments. Malignant forms arising primarily as such are relatively rare on the legs but occasionally the so-called "rodent" or "Jacob's" ulcer *(noli me tangere)* which is the same as the more properly designated *basal-cell epithelioma.* Starting as a small nodule, this tumor slowly develops from cellular elements of the skin.

A consideration of the special features and non-operative treatment of the common forms of ulcer will be made below, whereas the malignant forms will not be further dealt with here as no palliative treatment of

them seems justifiable, unless the condition when first seen is too hopeless (in view of distant metastases) to warrant radical operative measures. (Mention may be made in passing of a type of malignant pigmented tumor which occurs occasionally on the foot, ankle or leg either as a raised dark brown or black nodule or as a definitely raised papillary warty tumor, usually pigmented. The ultimate prognosis in this type is particularly hopeless unless early radical operative measures can be instituted. The color and question of involvement of popliteal or inguinal glands in these cases deserve careful examination.)

Pathology and Etiology.—Varicose veins when present in a severe form result in poor nutrition of the skin and subcutaneous tissue. Stagnation of the return flow of blood aids in the development of edema in which damage to the lymphatics may play a rôle. Repeated slight traumatisms followed by minor ulceration are apt to precede the chronic ulcer which is usually situated superficial to the vein, being said by Homans to "ride" the vein. There may be thrombosis of the latter, but most often, probably, there is not. Da Costa states that usually the worst types of ulcer are situated directly over one of the perforating *(communicating)* veins.

Few of the standard articles on the subject of varicose ulcer have seemed content to allow the varicose vein condition full responsibility for all cases of leg ulcer, Freeman (in *Keen's Surgery*) mentioning that damage to the lymphatics usually has more or less to do with the process. Da Costa, citing Homans, says:

"The other type of varicose ulcer follows in from six months to two years blocking of the iliacs (milk leg). . . . The lymph current is interfered with, the deep fascia is thickened, but is fibrous, areas of edema and scarlike formation are common."

However, the importance of the lymphatics in the causation of leg ulcer would seem to have been somewhat neglected until R. Prosser White, in a careful study of the literature and of his non-operative cases, called attention to this phase.

According to this writer while ulcers of the leg are four times more frequent in women than in men, yet the incidence of syphilis is estimated at from three to eight times greater in men than in women. This disparity tends to minimize the syphilitic factor in leg ulcers of women and at the same time leaves unexplained the much greater frequency of these ulcers in the female sex. Also, according to Balfour, the ration of the tendency to varicosity in males and females is as 3 to 2, which does not support the greater liability of the female to ulcers of the leg on the hypothesis of the large majority of them being due to varicose veins.

White calls attention to the fact that *phlegmasia alba dolens* (milk leg) occurs as a complication of pregnancy only in the ratio of 1:400,

whereas in his series of 55 females with ulcers of the leg a history of milk leg during the puerperium was present in 17 or over 30 per cent. Of the remaining female cases of leg ulcer, 10 were attributed to varicose veins, 9 to trauma, 7 to eczema, and 5 to syphilis (2 each due to sepsis and tubercule, and 1 to a burn, while 2 were not diagnosed). There were only 14 cases of leg ulcer in males (in his series) and of these 6 were accounted for by syphilis, 4 by eczema or psoriasis, 3 by trauma and 1 by tuberculosis. In his experience the variety following phlegmasia was considerably more difficult to secure good results with following treatment, while his results were good in the varicose ulcer variety.

Reviewing the pathology of *phlegmasia alba dolens* White inclines to the view that it is due to lymphangitis and lymphadenitis rather than to thrombophlebitis; lymphatic obstruction, as he says, is well known to produce the peculiar brawniness which accompanies so many chronic post-phlegmasia ulcers of the leg.

As affording some support to the view emphasized by White, it may be recalled that Professor W. S. Halsted conducted some experiments relative to the causation of swelling of the arm in carcinoma of the breast in patients who had undergone the radical operation with clearing out of the axillary lymphatics. He found that in experimental animals it was possible to divide all the structures of a limb, including all the vessels and lymphatics saving only the main artery, without the development of subsequent edema *unless infection supervened.* He was inclined to infer that a low-grade infection involving the remaining lymphatics was the cause of postoperative swelling of the arm in breast cases so afflicted.

Syphilitic ulcers of the leg are much more apt to occur in the upper and middle thirds of the leg, especially about the calf (Freeman). They result from the breaking down of cutaneous, subcutaneous or periosteal gummata. They are much commoner in the male (White). They usually lack the thickened margins of the non-luetic types and may present a ragged so-called moth-eaten appearance. Coffee-colored pigmentation of the surrounding skin is supposed by some to be more or less characteristic but may occur also due to extravasation of blood in the varicose type.

The so-called *traumatic ulcer* of the leg is often associated with the underlying factor of varicosities or postphlegmasia effects—lymphatic edema. However, in White's series there were 9 among the 55 cases in females in which these latter factors were excluded. In the traumatic ulcers sepsis is usually present and as a rule is secondary to the injury.

The tuberculous leg ulcer is quite rare, constituting only 3 of White's total of 69 cases, 2 being in females and 1 in a male. There is little to distinguish it clinically from the luetic form.

The eczematous or postpsoriasis type of ulcer may be recognized from the existence of accompanying lesions of the underlying disease or from a history obtained of its previous existence. This is a relatively rare form.

Treatment.—In any method of treatment of leg ulcers, either of the acute or chronic varieties, it is of the greatest importance to keep the patient in bed with elevation of the extremity. Any method of treatment employed, aided by rest in bed with elevation of the leg to facilitate absorption of edema and relief of venous congestion, is thus rendered much more effective. As it is obviously impossible to treat all of the chronic cases in this way (either because of refusal of such confinement or more often because the individual must remain at work), certain special methods of treatment of ambulatory cases have been devised and have through long usage proved fairly satisfactory.

Of such methods the use of Unna's paste or some modification of it in the form of a "jelly-bandage," as it is called in some clinics, has been extremely satisfactory for ambulatory patients who have to go as long as possible without redressing. Its disadvantages are that the paste has to be somewhat carefully prepared, preferably by a pharmacist, and that some time and skill is required in its application. However, these difficulties are of minor importance compared with its benefits. Such a bandage carefully applied may remain undisturbed for from one to several weeks.

The preparation and employment of Unna's paste as given by Da Costa is as follows:

"Dissolve 4 parts of the best gelatin in 10 parts of water by means of the hot-water bath. While the fluid is hot add 10 parts of glycerin and then 4 parts of powdered white oxid of zinc and stir energetically until the mixture is cold. Melt the 'paint' before using by placing its container in a hot-water bath. The extremity must be clean and thoroughly dry. Apply the paint (with a paint brush) from just above the roots of the toes to just below the knee. Cover the paint with a gauze bandage, put over this another layer of paint, then another bandage, and so on until three, four or five bandages have been applied. To prevent wrinkling apply the gauze in short pieces. The outer layer of the dressing is another coat of the paint. This dressing is worn from four to eight weeks unless it loosens sooner, when it should be changed. If the ulcer discharges freely and stains the dressing, cut a trapdoor in the dressing and apply dressings locally as often as possible."

In employing the above method it is of extreme importance first to have the leg elevated almost vertically for a sufficient length of time to cause disappearance of any edema which may be present. Otherwise the dressing will soon loosen and be of little benefit.

The use of adhesive plaster as advocated by Beck is a valuable form of treatment. This differs from the older technique in which the entire ulcer was covered with adhesive; in Beck's method of application the object is to overlap the skin edge and granular area with the plaster, leav-

ing a considerable central zone *uncovered* by adhesive for *drainage*. He states that with this method he has secured healing in many chronic ulcers prëexistent for years. The adhesive is applied either in the form of a ring with central hole, or, in the larger ulcers, by means of overlapping strips along sides, top and bottom, resulting in a square with central block defect. It should be noted that the adhesive strips should not include more than one-half or two-thirds the circumference of the leg.

This method (Beck) is a good one for chronic ulcers with fairly clean and not redundant granulation tissue. The epithelium attempting to grow in over the latter will not do so if the granular surface is elevated above it. For perhaps two or more reasons epithelial cells are apparently poor climbers: (1) when the granulations are at a higher level than the epithelium there is also usually an overlapping of the epithelial border with corresponding pressure effects on the epithelial cells; (2) when the granulation surface is hypertrophic (elevated) there is usually also infection present and it is a proverb among plastic surgeons that such a granulation surface offers a relatively poor culture medium for growth of new epithelium.

In explaining the growth of epithelium beneath adhesive plaster, Beck states that the adhesive prevents the granulations from growing higher than the skin level and that the under surface of the plaster acts as a path for the regeneration of epithelial cells "on the same principle as the vine would grow along a string or wire and cover . . . the . . . wall of a building." As to this last statement one wonders if the principle enunciated by W. S. Halsted many years ago of healing beneath a moist as contrasted with the slower healing beneath a dry scab is not involved. It was shown by both Halsted and Carrel that epithelialization occurs more rapidly when the growing border and adjacent granulation tissue are covered with a strip of thin gutta percha, the so-called *"protective"* tissue. The analogy of the epithelial cell and the tendril entwining about its string are not closely parallel.

Previous to the application of any (semipermanent dressing) such as strapping or Unna's paste, H. Prosser White frequently applies freely to the ulcerated surfaces or any patches of chronic eczema the (so-called) yellow paint:

℞	Camphor	ʒ ii
	Acidi carbolici	ʒ iss
	Hydrargyri perchloridi	gr. iv
	Acidi picrici	ʒ ss
	Tragacanth	ʒ i
	Alcohol	ʒ vi
	Tr. benzoin	ʒ ii

Fiat pinct.

This paint is a powerful antiseptic, desiccant, and at once relieves all itching and leaves a fine protecting antiseptic film over the limb.

The usually small persistent intensely painful ulcer ("irritable" ulcer) is often refractory; one may give several swabbings with yellow paint and then fill up the cavity with orthoform. This generally gives relief for forty-eight hours.

As White states, in ulcers following repeated attacks of erysipelas or occurring on a leg which has been the seat of white swelling (phlegmasia), the prognosis is gravely altered, whereas in the varicose or eczematous types when proper treatment is carried out the results are satisfactory to both patient and doctor. In ulcers with much discharge where it is possible to keep the patient in bed for a few days, the same author often employs as an antiseptic l'eau d'Alibour, the formula for which is (according to Sabouraud):

℞	Sulphate of zinc	gm. 7
	Sulphate of copper	gm. 2
	Camphor and saffron	āā gm. 50
	Water	c.c. 300

Sig: Dilute with 3 to 5 parts of boiled water and apply gauze wet with the solution repeatedly.

Much the same in principle as the "jelly-bandage" is the employment of starch (crinoline) bandages as advocated by Ekstein who states that with it he has secured healing in cases so severe that amputation had been advised, without recurrence, and with none save ambulatory treatment without interference with the individual's occupation. The method is as follows:

The leg is raised until the swelling has almost disappeared. Cleanse the ulcer with benzin and cover with iodoform gauze heavily coated with 5 per cent boric acid in petroleum ointment. With the elevated position of the leg maintained, carefully bandage the leg from the metatarsus to the knee with four-inch gauze. Over this apply compressive moist starch (crinoline) bandages (four to five-inch widths). Continue elevation of the leg until the bandage is entirely dry. The patient returns to work with instructions to report back when the bandage has become wet through, loose or is causing pain. How soon this occurs depends in part on the size of the ulcer and amount of secretion.

The statement is attributed to the enthusiastic user of this method (Ekstein), that three or four such bandages, in turn properly applied, are sufficient to effect the cure of palm-sized ulcers with callous edges and of a depth often extending to the fascia. After healing, an elastic stocking or tricot should be worn and strict orders given to cleanse the leg only with benzin or ether for the next three months or so.

One's only comment on the above is that one needs good starch (crinoline) bandages and that these may be difficult to obtain. Either through age or original low starch content those handled by the surgical supply houses are not always satisfactory, consequently lacking drying and compressive qualities. Where the material is made in the hospital where it is being continually used, it is usually of better quality. For applying such bandages as this and those of the zinc oxid gelatin type a low couch with some form of movable foot rest which can be placed on the foot of the couch, or near it, provided the foot be then raised about a foot above the rest of the body, facilitates matters.

A third method, that of Gurd, utilizes a continuous adhesive plaster support from the base of the toes to the knee. By this method it is claimed that dressings are not necessary oftener than every second or third week, provided the technic is carefully carried out. The leg is bathed in washing soda solution and thoroughly cleansed with soapsuds and a soft brush. Any sloughing material is excised with scissors, followed by cleansing of the whole leg with benzin, and occasionally alcohol. The patient now *lies on his back with his leg in a nearly vertical position against the wall for thirty minutes to two hours, or until the edema has disappeared.* [Complete drainage of the edema is of fundamental importance in this method, since adhesive plaster does not contract (compress) as does crinoline (starch), upon drying.] Strapping with zinc oxid adhesive strips is now applied. The strips should be 2.5 to 3.5 cm. in width and sufficiently long to overlap when placed circularly about the leg. Starting from the base of the toes the foot is encircled by strips; each layer overlaps that already in position by at least 1.5 cm. Care must be taken to prevent cutting edges about the malleoli but it is unnecessary to cover the heel. The strapping is continued over the ankle and up the leg as far as the tuberosities of the tibia and the head of the fibula.

The adhesive is applied over the ulcer in the same manner as elsewhere, although as the author (Gurd) says it is probably an advantage here to fix the successive straps to the skin on the near side of the ulcer and, before applying to the skin of the opposite side, to exert a slight amount of tension in such a way that some approximation of the edges of the ulcer is produced. If there is much discharge from the ulcer a gauze and cotton wool dressing may be applied on the outside of the adhesive to absorb the exudate.

If the patient can be kept in bed for two or three weeks, wet dressings of Dakin's solution are very valuable and with elevation of the leg healing may often be obtained. The dressings should be changed every two to four hours (save at night), otherwise its best effect is not ob-

tained owing to an impermeable layer of fibrin sealing the granular surface and preventing access of the antiseptic solution. Dichloramin-T in the chlorcosane oil is scarcely so effective but is useful with ambulatory cases when frequent dressings (every one or two days) can be employed.

Other drugs which have been used a great deal in these cases are scarlet red in the form of an 8 per cent ointment (Staige Davis) particularly for stimulation of the growth of epithelial cells; balsam of Peru, both the ointment and the balsam; and thymol iodid (aristol) in the form of powder. Daily wet dressings of 2 per cent aluminum acetate followed in a few days by daily dressings of spirits of camphor used with rubber to prevent evaporation are highly recommended by Da Costa in ambulant cases.

NON-OPERATIVE TREATMENT OF INFECTED WOUNDS

It is practically impossible to handle this subject satisfactorily here because of the fundamental importance of the proper preliminary surgical (usually operative) treatment of wounds in general. This concept was not altered by any innovation in therapy made during the World War, and involves now as always, although more generally appreciated since the War, the surgical principles of asepsis and antisepsis, making necessary the operative cleansing of wounds with removal of foreign bodies, excision of traumatized tissue, and establishment of proper drainage. In wounds which must be left for secondary closure or for healing by granulation, proper drainage is the *sine qua non* of success. It is obviously not within the scope of this work to review the operative technic involved.

In general it may be said that, provided the operative technic has been properly accomplished and asepsis and proper drainage established, the matter of healing may be effectively accomplished with the aid of the simpler forms of dressings. While the use of Dakin's solution with the elaborate Carrel technic of wound irrigation was a distinct advance, it is hardly possible to employ it properly save in the hospital with the aid of personnel trained in its use. Even in the hospital its use is not imperative. The use of wet dressings (compresses) frequently changed and of boric acid or saline solution will always be a valuable method. Dry gauze (sterile) is effective alone when frequently changed. Care should be exerted in placing gauze into a deep wound to place it in rather loosely so that it will not act as a pack in damming back secretions and by pressure cause necrosis of the tissues it presses against (it may be borne in mind that the bulk of such material increases largely when it becomes wet).

The employment of heliotherapy and artificial light are becoming

valuable adjuncts. The various dyes advocated are not of primary importance so far as has yet been demonstrated.

In the treatment of superficial granulating wounds the problem is often rather similar, although often less complicated, to the therapy of burns and leg ulcers. Areas of large extent should have the systemic benefit of greatly increased fluid intake. Large areas should be skin-grafted at the proper time. Various substances have been used, such as scarlet-red for stimulating the new growth of epithelium (see also above the use of adhesive plaster, Beck).

It is advisable to administer the prophylactic dose: 1,500 units (in adults) of tetanus antitoxin in every case of perforating wounds of the skin.

HERNIA IN INFANCY AND CHILDHOOD

Introduction.—In adults it is generally agreed that the radical operation is the only standard method of treatment, save in individuals in whom for some constitutional reason operation is contra-indicated, and in whom the wearing of a truss is to be advised. Since the use of local anesthesia in hernia operations has become fairly general, there are relatively few cases on whom it is unsafe to operate. But *in infancy* the problem is by no means so clearly defined, so that it would seem advisable to limit the discussion here to this group of cases.

There is relatively little in the literature on the non-operative treatment of hernia, either in the current journals (aside from occasional case reports) or in the textbooks, and indeed it must be admitted that with constant advance in methods of anesthesia the tendency is toward operation in more and more cases even in the first years of life. Samuel W. Kelley in his too little known volume on *Surgical Diseases of Children* has written what is by far the best consideration of non-operative methods and selection of cases for non-operative or operative treatment that I have been able to find. The summary below is largely derived from his chapter on this subject and to him full credit is given. It is rare to find anything written by one who is a surgeon or an internist *per primam* which embodies such careful consideration of both surgical and non-surgical measures.

Causes, Frequency and Varieties.—Some of the causes are: faulty development of the abdominal wall, general weakness of the latter incidental to illness, malnutrition, or faulty innervation; overstretching due to increased intra-abdominal pressure (distention) from whatever cause: tenesmus or strangury, associated with diarrhea, constipation, rectal polypus, vesical calculus or narrow preputial or urethral orifice. Persistent coughing or crying, the use of a tight abdominal band, or an im-

properly adjusted truss for umbilical hernia may cause development of an inguinal hernia.

In general it may be said of the causative and perpetuating factors concerning the hernia that "the probable results, if treated by trussing or by operation, the type, fitting, and management of the truss, and the best time for operation, if the latter is necessary, must be considered."

Umbilical and inguinal hernia are very common; femoral, obturator, and perineal herniæ do not occur. Strangulation occurs less often in children but should always receive prompt treatment.

Treatment of Strangulated Hernia.—"*If the strangulation has existed only a few hours* and the patient is in fair condition, administer an anesthetic (ether), place in position to relax the muscles at the hernial site and secure benefit of gravity for reduction. *Try taxis with the utmost gentleness.* The swelling is pressed upon slowly and persistently for some minutes so as to squeeze some of its fluid or gaseous contents into the abdominal cavity. An attempt may be made to lift the swelling gently away from the constriction as if drawing it out of the hernial opening. With the ends of the fingers of the other hand the neck of the sac is slowly pushed from side to side and palpated. Perhaps the hernia will gurgle and slip away into the abdomen. If these maneuvers do not succeed in reducing it, operation should be prepared for at once. If in the first place no anesthetic is at hand, codeia or morphia should be given and the patient propped into position (so that gravity favors reduction) and an ice-bag applied to the mass. If the patient's temperature is subnormal (or shock otherwise is shown), heat, hypodermoclysis, and stimulants are indicated."

Umbilical Hernia.—There are two usual varieties: in one the protrusion really is through the umbilical aperture; in the other the projection is in the linea alba directly above the umbilicus.

Diagnosis is made by the position and feel of the swelling. It is soft and elastic and easily reducible as a rule, reappearing on slightest coughing, straining, etc. In some cases it seems to be painful and the child is fretful. It is always unsightly.

The prognosis is good. Rarely in children will these become strangulated or persist to adult life. Some, however, will not close without treatment or operation.

Treatment of Umbilical Hernia.—It is often treated "domestically" and not rarely by the physician with but little improvement over the methods of the mother or her friends. Pads of cotton or muslin or a coin or piece of sheet lead are bandaged on and not very rarely an inguinal hernia is produced by bandaging an umbilical hernia too tightly.

Sometimes a hemisphere of beeswax with convex side inward is ap-

plied and held firmly with adhesive (or other means). Or one can buy hard rubber pads usually conical in shape with elastic webbing. These are useless (Kelley). The webbing will not stay in place and the conical projection intended to keep the hernia reduced *also tends to keep the hernial defect open.*

A flat surface is best, preferably of gutta-percha or rubber with little pegs or buttons on the back of it to which are fastened the folded over ends of adhesive straps. Preferably four pegs and a flat button of square shape, such as that of Kelley's design, should be used. This does not tend to keep the opening patent as do those of conical shape.

When the abdominal muscles are weak, flabby or overstretched, the strapping should be applied just tightly enough to support them. The adhesive strapping can be unbuttoned and the pad removed at any time, the skin cleansed and powdered, and the pad washed and replaced without removing the adhesive. Before applying originally one should cleanse the skin carefully (soap and water and alcohol) and flame the adhesive before placing. If this is done the strapping can be left on for weeks together and the mother or nurse can do the rest. In a few weeks or months the opening usually closes.

Inguinal Hernia; Diagnosis.—The differential diagnosis includes consideration of encysted hydrocele of the cord, of congenital hydrocele; or hydrocele of the tunica vaginalis and funicular process, infantile hydrocele or funicular hydrocele; or encysted hydrocele of the canal of Nuck; or cyst of the hydatid of Morgagni, which strongly resembles hydrocele. Kelley has often seen children wearing trusses on one or another form of hydrocele. The latter has a different feel from hernia and is translucent. If reducible it disappears gradually and not in a mass, and reappears in the same manner. (Undescended testicle is usually easily detected.) Direct inguinal hernia is very rare in children.

Hernia and undescended testicle in combination may have adhered together, with the peritoneum between, and, as the testis descends, the bowel is pulled with it and when reduction of the hernia occurs the testicle recedes also.

Hematocele is subsequent to trauma, the history of which with actual ecchymosis or other evidence of trauma may be present. Tumor of testicle is apt to be hard and often nodular.

A congenital, funicular, infantile or encysted hernia is suspected when a hernia suddenly appears in a young subject promptly attaining a size greater than would be suspected with the gradual formation of a sac.

Ordinary acquired hernia appears late and increases slowly in size and, if it descends into the scrotum, remains separate from the testicle.

The congenital variety appears early, descends suddenly and often promptly takes a lower position than the testicle.

The funicular hernia is probably far more common than either the in-

fantile or the encysted forms. In this the hernia appears early, descends rapidly, but usually keeps the testicle below it.

Non-operative Treatment and Considerations for and against Operation.—In every case removal of the cause, cough, constipation, phimosis, calculus, frequent crying, malnutrition with emaciation, or whatever it may be, is important. In some cases this, with keeping the child in a horizontal position for a time, will end the trouble.

In other cases some form of support must be used. The essential points are that the truss shall hold the hernia, and that it shall do so without more pressure than is necessary under the customary strain. In order that it should do this no matter what position the child may assume or what exercise it may perform, it should be constructed so that the surgeon can easily alter or adjust it with precision. No perineal band is required if the truss fits properly, but when it is necessary one may better use a piece of rubber tubing than a leather strap. According to Kelley:

"A spring truss if covered with hard rubber or celluloid is best. No infant is too small to be fitted and it is a rare hernia that cannot be held. Some cases can be permanently cured in a few months; most cases can be cured with a truss within two years.

"After application the hernia should never be allowed to escape during the whole period of treatment and the truss should be worn day and night and every moment. When it is necessary to change the truss or wash it, the hernia must be carefully held in by the fingers of the nurse or mother. The skin beneath the truss must be kept scrupulously clean and dry. The mother or nurse should be clearly instructed that, if the rupture comes out while the truss is on, the truss is to be immediately taken off, the hernia reduced, the truss reapplied and the child is to be brought to the surgeon and the occurrence reported.

"The hernia may be considered permanently cured when the pillars are felt to be of normal strength and properly approximated, with no impulse on continuous coughing or straining, and when this condition has been maintained for several weeks after leaving off the truss.

"As a rule cases which cannot be held with a truss applied by skillful hands, and cases in which trussing has been properly tried for a period of two years without a cure should, if the child has reached four years of age, be subjected to operation.

"If proper home care is impossible operation may be justifiable under four years of age.

"If the patient can be safely carried along, five or six years of age is a better time to operate than at four years.

"If he is past four years he is not so likely to be cured by a truss.

"In puny infants and very young and rickety children the tissues are so poor it is better to use a truss for a time until the general condition is better, otherwise the operation may fail.

"The complication of hernia with undescended testicle argues in favor of rather than against operation."

As Kelley says, "cases have been operated on at very early ages successfully," and one believes that in babies in good condition this tendency is growing. Wound infection from wetting is almost obviated by a properly applied collodion dressing at the close of the operation.

HYDROCELE

Varieties and Non-treatment.—Diagnosis of the kind of hydrocele present is important in determining the treatment. If a translucent swelling (flashlight test) involving the scrotum and cord can be reduced with the patient recumbent, aided by gradual pressure, the hydrocele is probably the so-called "congenital" hydrocele due to potency of the upper portion of the funicular process of peritoneum (from which normally the tunica vaginalis is formed, followed by atrophy of its upper portion) with non-closure of its original opening into the general peritoneal cavity. If the testicle can be felt distinct from and below the hydrocele, the tunica vaginalis is normally formed. If now reduction of the hydrocele can be effected, the type of the latter is that of the so-called "funicular" hydrocele, similar to the "congenital," save that the lower part of the funicular process of peritoneum has developed and closed normally.

In both these varieties the treatment (Kelley) is primarily by trussing, and operation is only indicated in the event of failure of this method.

"Hydrocele of the cord" is similar to the "funicular" type save that it cannot be reduced because of closure of the communication of the funicular process with the general peritoneal cavity.

"Infantile" hydrocele ("encysted" hydrocele of Moschowitz) involves the length of the cord and scrotum including the space of the unclosed vaginal process, but differs from the "congenital" variety in that the opening into the peritoneal cavity is closed.

Hydrocele of the tunica vaginalis testis is less often present in children than the other types, but is the common form in adults. The translucency and characteristic feel make the diagnosis.

Treatment.—For these last three types the treatment consists in supporting the swelling by some form of "supporter" so that it is not subject to being caught between the thighs, followed by tapping if necessary on account of its size or non-disappearance in a few weeks. *Repeated* tappings are advocated by many surgeons in preference to injection methods. Where carbolic acid has been used fatal results have been known to occur. Whereas the types may be clearly differentiated mentally, it is not always certain that the funicular process is closed; one would not

wish to inject even a few drops of carbolic acid into a sac which might communicate with the general peritoneal cavity. The effects in infants and children of this agent are particularly toxic.

If after repeated tappings the hydrocele does not subside operation may be advisable.

There is a further type in which a small funicular hernia exists along the cord (above) with a hydrocele of the "infantile" type in front of and below the hydrocele; this is the so-called "encysted" hernia (Russell). Diagnosis of this type is difficult save at operation and conservative measures usually fail.

SPRAINS AND STRAINS

The term "sprain" is usually applied to injuries of one or more *ligamentous* structures about a joint, while "strain" applies to similar stretching or partial rupture of *tendons* commonly at the points of attachment. In athletic parlance the sufferer from a strained tendon commonly refers to having "pulled" a tendon.

Both of these injuries while most frequently involving rupture of a few or many fibers of one or more components of a *ligament* (some ligaments having two or three divisions), or tendon, may involve the pulling off of a scale of bone at the point of attachment. In such instances in the case of ligaments a "fracture sprain" is said to exist, but the treatment is the same although the disability may be longer.

The differential diagnosis cannot be fully gone into on account of lack of space. The whole subject including the diagnosis and treatment of both external and internal derangements of the joints is so clearly and succinctly treated by Sir Robert Jones in his brochure of the Oxford War Primer Series, *Injuries to Joints*, as to make it an invaluable aid to the practitioner. If there is any other book of its size containing so much accurate information conveyed in such an interesting and understandable manner, one must confess ignorance of it.

Treatment.—The underlying principles of treatment of sprains and strains are concerned chiefly with rest and increasing the blood supply of the injured structure. The location of the injured ligament is easily determined by palpation with the finger tips which elicit most marked tenderness at the point of rupture. If seen immediately there may be no general swelling but a localized globular effusion one-fourth inch to an inch or more in diameter over the injured ligament. Vibratory massage given at once with the pads of the finger tips making firm pressure over the swelling may cause disappearance of the swelling in a few minutes. As recommended by Jones a small pad composed of several folded layers of

adhesive should be applied directly over the area previously occupied by the swelling and adhesive strapping applied. The slight pressure of the pad prevents largely or altogether reaccumulation of the fluid, while the strapping is applied in such a manner as to maintain relaxation of the ruptured ligament.

In the case of the ankle, after first shaving the leg and ankle, a strip of adhesive plaster two and one-half to three and one-half inches in width and sufficiently long to extend two-thirds or more the length of the leg is prepared and applied first on the uninjured side of the leg and ankle beginning above and crossing the malleolus below. The foot must be held strongly everted or inverted, depending on whether the external lateral ligament or the ligament on the mesial surface is torn; dorsal flexion of the foot is also necessary, especially if the anterior slip of the ligament is involved. The foot now being held in such a position as to cause relaxation of the injured structure, the adhesive strap crosses below the heel and making firm traction upwards is applied over the malleolus and side of the leg. Additional strapping is now placed so as to cover snugly the entire ankle region. Perhaps best, using three-fourths inch to one inch strips, these may be applied in a circular or figure-eight manner. (This method has been popularized by Whitman and others. It will be found somewhat simpler to apply and fully as effective as the method of Gibney, in which the front of the ankle is left uncovered.) Over the adhesive a bandage is applied to insure adhesion of the strapping to the skin. It has been found helpful to sprinkle from a drop bottle a little ether along the length of the adhesive plaster (sticky side) before applying to the skin. If one is working alone it may aid the patient to maintain the desired position of the foot by taking a couple of turns of muslin bandage about the distal end of the foot, the two ends of the bandage being tied behind the patient's shoulders or neck. By leaning backward slightly the eversion and flexion may be maintained comfortably and easily.

With such a strapping the patient is able to walk with relatively little discomfort and should be encouraged to get about, as the exercise will furnish the increased blood supply which constitutes the other valuable phase of the treatment. If the strapping has been applied after swelling of the ankle region has become general it will be necessary to reapply a similar strapping when the primary one has become loose, in a day or so, from subsidence of the swelling. About three such applications will be necessary in the average case, each staying on a few days longer than its predecessor. The final one is left on for ten days more or less as a preventive measure against "turning" the ankle again.

Strains of the tendinous insertions of the large muscles of the trunk may often be at once relieved by similar means without necessitating cessation of work on the part of the patient. One refers to such muscles as

the *rectus abdominis* and the *erector spinæ*. A long broad (three inches or more) strap is applied over the muscle extending almost the length of the trunk and held in place securely by broad cross straps. It is of prime importance to have the individual bend the body in the position necessary to relax the muscles before strapping. Applicable to musculotendinous strains of the above type or to those of the long tendons of the extremities is the method suggested by Jones; firm pressure is effected over the area of effusion by means of a pad of folded adhesive held in place by a circular adhesive strap; a similar pad and strap are placed immediately over the tendon just above the inflamed area; "this acts as a stop, preventing the tension on the muscle from being transmitted with full force to the injured attachment," and is "comparable to the half-turn round a post which a sailor takes with a rope when he wishes to check a movement which he could not stop by the direct application of his strength. This is no new principle, although sadly overlooked by the profession, for every workman who puts a strap round his wrist to ease a strained tendon is putting it into practice" (Jones).

Owing to the relatively greater complexity of the internal and external anatomy of the knee-joint, and the frequency with which injury of the internal structures may be present, neither the diagnosis nor the treatment is so simple here. Sprain of the internal (that is, the mesial) ligament is accompanied by pain at the inner side of the knee particularly when the foot is twisted outward or on passive stretching of the ligament by the examiner. There is tenderness on pressure confined to the line of the ligament (Jones). The points of tenderness on pressure associated with displacement of the semilunar cartilages lie in front opposite the joint and at either side of the ligamentum patellæ. In cartilage injuries there is present, or a history of, "locking of the knee on attempted full extension, or a sense of something slipping inside the joint." In injuries of a bruising character there may be injury of the postpatellar fat pad, swelling of which becomes manifest by local tenderness on full passive extension with visible swelling on each side of the ligamentum patellæ.

The treatment of sprain of the internal (mesial) "lateral" ligament, according to Jones, consists in applying a posterior splint which should remain on until union is complete, usually in about two weeks; deviation of the body weight from the ligament by walking with the toes turned in; relief of strain on the ligament by having the inner side of the heel of the patient's shoe made a quarter of an inch thicker than the outer.

Immediate packing of ice about a sprained knee, the limb being extended in an improvised fracture box, is reported to be an effective means of preventing the usual effusion into the knee-joint. Application of this method will, however, not always be possible.

In conclusion it seems scarcely necessary to state that radiograms should be made in all doubtful cases in injuries about the above or other joints.

SINUSES AND FISTULÆ

Persistent sinuses in various parts of the body indicate as a rule some one of the following conditions or complications: osteomyelitis, foreign body, improper drainage, tuberculosis of lymph glands, bone, joint, or soft parts, and, very rarely, syphilis.

Spontaneously developing fistulæ are quite rare except those about the anus. Fistulæ in the region of the salivary glands, if tuberculosis of neighboring lymph-nodes is ruled out, should make one think of calculus of whichever salivary duct is adjacent, and radiograms should be made if the stone in Wharton's duct cannot be palpated or probed. Recently a case was seen in which the calculus had begun to ulcerate through the duct near the sublingual papilla, and was easily removed with small forceps without anesthesia.

Fistulæ about the anus are not so commonly tuberculous as was previously supposed. As stated by Hill and Landsman, the picture usually presented clinically by the tuberculous variety is as follows: The external opening is patent, irregular and usually of larger size than in the pyogenic variety. It is more or less insensitive to probing and discharges a thin dirty gray material (seldom thick or creamy). The surrounding skin is bluish in color, unhealthy in appearance and is apt to be undermined by the tuberculous process. After listing the above as the typical clinical picture, these authors proceed to record two cases in which none of the above characteristics were present. Personally one recalls having carefully studied the histological section of several fistulæ in ano without finding evidence of other than an ordinary chronic pyogenic process.

The so-called "pilonidal" or "sacrococcygeal" sinus while less frequent than the above varieties is of some interest and its diagnosis is important as may be inferred below. The opening or openings, for they may be multiple, are always situated behind the anus in the midline between the folds of the buttocks. Not infrequently a tuft of hairs may project from the mouth of the tract, this characteristic giving rise to the name "pilonidal" (meaning nest of hairs). The tract is lined with squamous epithelium and may communicate with a definite *cyst,* deeply placed and similarly lined. These are probably sequestration dermoids developed from remnants of that part of the neurenteric canal known as the "postanal gut," and their sinuses result from persistence of a portion of this embryonic canal. Clinically they are of interest in that they may exist indefinitely without knowledge of the possessor unless infection supervenes, when an abscess usually results which when ruptured or in-

cised leaves behind a chronic discharging fistula. It is extremely rare for this sort of a sinus to communicate with the rectum but it often leads to the space in front of the coccyx where the cyst may be located. Occasionally infection of these sinuses have led to the incorrect diagnosis of osteomyelitis of coccyx or sacrum.

Treatment.—What can one say of the non-operative treatment of the various sinuses and fistulæ referred to above? While the injection treatment with Beck's bismuth paste may be tried, the employment of aseptic dressings with the use of such mild antiseptics as thymoliodid powder is often as effective. Non-operative treatment is rarely curative of the above types unless the underlying pathology is eradicated by operative measures.

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